

# THE AMERICAN SURGEON

Vol. 25, No. 3

March, 1959

## BED PEDALING AS AN ADJUNCT TO POSTOPERATIVE AMBULATION FOR HASTENING AND IMPROVING CONVALESCENCE

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In 1940, while performing the surgery in a tuberculosis sanitarium, one of us (H. D. C.) became interested in postoperative activity in surgical patients. On reviewing the literature, it was found that Wilson<sup>15</sup> in 1912 had advocated flexing and moving the extremities to prevent embolism in the postoperative period, and Gamble<sup>4</sup> as early as 1935 had advocated the use of pedals postoperatively to prevent embolism and phlebitis. Since a part of the routine treatment for these patients was strict bed rest, pedaling with an apparatus attached to the foot of the bed was instituted. We were pleased to note that those patients using pedals routinely recovered from their surgery more rapidly than those who were not given pedals. A study of the incidence of phlebitis and embolism in this institution prior to the advent of pedaling compared to the frequency of these complications after pedaling was instituted showed that in the latter group convalescence was hastened, and these complications were markedly lowered.<sup>2</sup> This was the only exercise used postoperatively on these patients.

About the same time the advantages of postoperative ambulation had been proved. It had been shown to result in a shortened postoperative convalescence with fewer complications.<sup>6, 8-11</sup> After we began postoperative ambulation as a routine procedure for most surgical patients, it was observed that the use of pedaling with ambulation seemed to have some advantages over ambulation alone, and there were some occasions when ambulation was not possible or desirable. There were instances when ambulation was ordered but was misinterpreted by nurses as sitting on the side of the bed or in a chair. We felt

that this might be as conducive to the formation of phlebitis and secondary embolism as bed rest, since it is known that when the body is placed in a vertical position, reflex vasoconstriction occurs which may slow the circulation time.<sup>14</sup>

There have been some patients who refused to ambulate the first few postoperative days but would agree to pedaling, and it was noted that they had done as well as those who accepted the usual postoperative ambulation program. In some patients we have not started ambulation for several days postoperatively, such as cases of abdominal-perineal resections where there has been difficulty in closing the pelvic peritoneum or where we have not used a rectal pack. In these cases we have used only the pedaling exercises and have noted that these patients convalesced as well and were as free of the forementioned complications as those who ambulated early. While ambulation is not feasible during the administration of intravenous solutions and it is at times hampered by various tubes in natural or man-made orifices of the body, pedaling can be accomplished at any time with beneficial results.

The advantages of pedaling were first judged through clinical observations and the favorable remarks of patients who stated they "passed their gas better," it "toned them up," etc. An attempt was made to take tracings of the intestinal peristalsis before and after pedaling by making kymographic tracings using Miller-Abbott tubes. This, however, was not successful. It has been noted, however, that auscultation of the abdomen showed greatly increased borborygmi after pedaling. In many instances, patients have asked for the pedals when they felt the need for passing flatus during their early

postoperative days and stated this was more effective than walking.

Potts<sup>12</sup> noted that in a series of 518 patients who had undergone major surgical procedures and who performed deep breathing and leg exercises, that there were no cases of pulmonary embolism or thrombophlebitis. Operations upon children under 13 years of age and minor surgical cases were excluded from this series. To substantiate this observation, Potts and Smith<sup>13</sup> measured the changes in the blood volume flow through the inferior vena cava of dogs and noted that simultaneous elevation of both hind legs produced an increase varying from 100 to 150 per cent of the volume flow of the blood. Contraction of the muscles in both hind legs occurring coincident with elevation produced an increase of more than 250 per cent in volume flow which was further increased by deep respirations. From these observations it appears that deep breathing, muscle exercises, and elevation of the lower extremities are of value in increasing the venous return flow and aid in preventing thrombus formation by diminishing stasis of blood elements which might lead to the beginning formation of thrombus. Kniseley and co-workers<sup>5</sup> have shown that after trauma there is a sludging of the red blood cells leading to their agglutination. When the blood flow is slowed or retarded, the sludged red cells may form the nidus of a thrombus, having the tendency to adhere to the walls of horizontal veins. It has been demonstrated by Baker and Sedwitz<sup>1</sup> that when Diodrast is injected in the veins of the legs of a subject lying still, the opaque medium will remain visible by x-ray as long as 15 min. The dye immediately disappears in the general circulation, however, when movement of the leg muscles, flexing the knee, or movement of the toes is performed. The clinical importance of these findings is more paramount when it is recalled that the deep veins of the lower legs must be regarded as the most common site of origin of venous thrombosis.

Circulation times were measured in a small series of normal male subjects ranging in age from 16 years to 49 years with the subjects at rest, and then following 3 min. of pedaling. Additional observations were made after 5 min. of rest and then following 3 min. of brisk walking. The average circulation times were as follows: resting 20.5 sec., pedaling (3 min.) 13.5 sec., walking (3 min. walking after 5 min. rest) 16.8 sec. This shows a greater acceleration of circulation time following pedaling than ordinary ambulation.

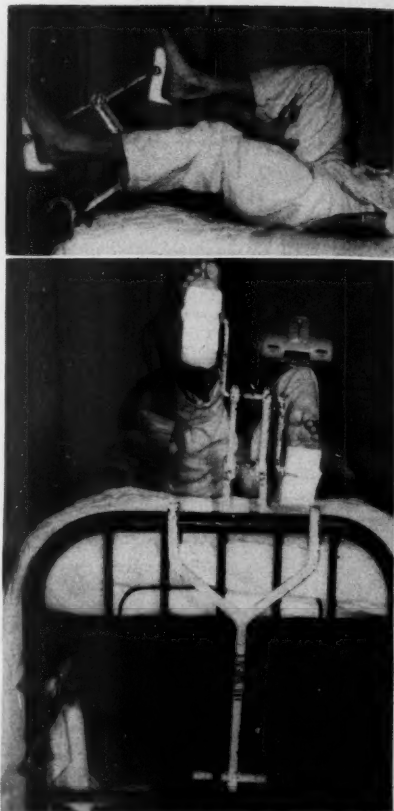


FIG. 1. Anterior and lateral view of pedaling apparatus which is used routinely in postoperative surgical patients.

The pedaling apparatus usually used is similar to the one previously described by one of us (H. D. C.)<sup>3</sup> (fig. 1). The DePuy Company is now manufacturing an easily portable set of pedals which is also being used. At the present time our private hospitals have these instruments for each surgical floor. On the evening of surgery the patient is encouraged to start using the pedals.

Leithauser<sup>7</sup> states that 99 per cent of his surgical patients get out of bed to walk immediately after recovery from anesthesia postoperatively. We find it is not unusual for patients having had major surgery to refuse ambulation during this period due to "anesthetic hangover" associated with lethargy, vertigo, syncope, nausea, and vomiting. The pedals are accepted, however, at this time and used. With the first period of use, the period of pedaling is from 10 to 15 min. From

the first postoperative day until discharge from the hospital, patients pedal from 10 to 15 min. three times a day in conjunction with ambulation.

A review of all our major surgical cases for the past three years in one of our private hospitals was made, excluding all breast, thyroid, minor, and rectal surgery, and all patients under the age of 18. The reason for the latter exclusions were that, in our experience, postoperative embolism and thrombosis were rare in this age group.

The cases we surveyed were predominately abdominal operations. There were 978 consecutive cases from January 1, 1955, through December 31, 1957, and only one instance of a known postoperative embolism could be found in this series. The number of instances of thrombophlebitis is not known, as none were found in the patients' hospital records. Since some of these cases may have developed thrombosis after leaving the hospital, we can not state the incidence of thrombophlebitis but know that the incidence must be small.

The one patient who developed an embolism was a female, Christian Scientist, 59 years of age, whose husband had recently died. On admission to the hospital it was noted that she was quite dependant and depressed. Cholecystectomy was performed on August 24, 1956, and her convalescence was relatively uneventful, but we were unable to urge her to pedal or to ambulate for the first few postoperative days. During this period she was morose and lay quietly in bed. Near the end of her hospital stay she began pedaling and ambulated fairly well. She was discharged on September 2, 1956. On returning to her home she again remained in bed, and on September 6, 1956, was readmitted to the hospital with the findings of a pulmonary embolism confirmed by roentgenograms of the chest. Anticoagulants and routine pedaling were started with the patient recovering and being discharged from the hospital on September 15, 1956. It is possible this patient would have developed her embolism even if she had been more vigorous and faithful in her use of pedals and ambulation. With her reluctance to be active postoperatively, however, the proper conditions were set for the occurrence of her embolic complication.

It is not intended that the foregoing presentation should in any way discourage the practice of postoperative ambulation. We feel the adoption

of this form of activity was a great step forward in hastening postoperative convalescence and reducing its complications. We believe, however, that the addition of pedaling to ambulation in the postsurgical period is an adjunct worthy of attention. It is our feeling that there are times when ambulation may be contraindicated or impossible, and in these instances pedaling can be substituted with benefit. Considering the findings of Potts and the results of our studies on circulation times comparing pedaling and ambulation, we believe that pedaling is a more effective activity than ambulation in the prevention of postoperative thrombosis and embolism.

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REFERENCES

1. BAKER, E. C., AND SEDWITZ, S. H.: Observations of venography of the lower extremities. *Radiology*, 41: 451, 1943.
2. COGSWELL, H. D.: The prophylaxis of postoperative thrombosis and pulmonary embolism. *J. Indiana M. A.*, 35: 304, 1942.
3. COGSWELL, H. D., AND THOMAS, C. A.: An apparatus for the prevention of post-operative circulatory stagnation. *Surgery*, 10: 323, 1941.
4. GAMBLE, H. A.: Prevention of postoperative embolism and phlebitis. *Am. J. Surg.*, 28: 93, 1935.
5. KNISELEY, M. H., BLOCH, E. H., ELIOT, T. S., AND WARNER, L.: Sludged blood. *Science*, 106: 431, 1947.
6. LEITHAUSER, D. J.: *Early Ambulation and Related Procedures in Surgical Management*. Charles C Thomas, Springfield, Illinois, 1946.
7. LEITHAUSER, D. J.: A survey on early ambulation after surgery. *Surg. Gynec. & Obst.*, 106: 100, 1958.
8. LEITHAUSER, D. J., AND SARAF, L.: The criteria for ambulation of the injured patient. *S. Clin. North America*, 33: 1059, 1953.
9. LEITHAUSER, D. J., SARAF, L., SMYKA, S., AND SHERIDAN, M.: Early ambulation in prevention of postoperative thromboembolism. *J. A. M. A.*, 149: 268, 1952.
10. PALUMBO, L. T.: Early post-surgical ambulation. *J. Iowa M. Soc.*, 45: 12, 1955.
11. PALUMBO, L. T., PAUL, R. E., KATZ, I. A., AND MAZUR, T. T.: Effects of early postoperative ambulation. *Postgrad. Med.*, 13: 206, 1953.
12. POTTS, W. J.: Pulmonary embolism. *Ann. Surg.*, 111: 554, 1940.
13. POTTS, W. J., AND SMITH, S.: Pulmonary embolism. *A. M. A. Arch. Surg.*, 42: 661, 1941.
14. WILKINS, R. W., HALPERIN, M. H., AND LITTER, J.: The effect of the dependent position upon blood flow in the limbs. *Circulation*, 2: 373, 1950.
15. WILSON, L. B.: Fatal post-operative embolism. *Ann. Surg.*, 56: 809, 1912.

## ENDOMETRIOSIS\*

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Endometriosis is functioning ectopic endometrial tissue, occurring in two forms: internal endometriosis and external endometriosis. *Internal endometriosis* or adenomyosis involves the uterine musculature, and *external endometriosis* comprises the lesions occurring elsewhere in the body other than the uterine musculature.

### *Internal Endometriosis*

Internal endometriosis may be diffuse adenomyosis involving either the anterior or posterior walls, or both. In such an event, there is hyperplasia of the musculature resulting in thickened walls and some enlargement of the uterus. This is usually symmetrical. There may be localized nonencapsulated areas of adenomyosis, and there may be submucous growths, at times large enough to protrude through the cervix. This type of lesion, in some instances, is responsible for an increased menstrual flow. A fourth type is circumscribed adenomyomas, which resemble fibroids, but differ in that they contain endometrial glandular tissue.

### *External Endometriosis*

External endometriosis has been found to be widely distributed throughout the body; however, it is usually confined to the region of the lower abdomen and external genitalia. Following a study of 569 cases, Hayden<sup>1</sup> found the distribution in order of frequency to be as illustrated in table 1.

### HISTOLOGY

Frequently, typical uterine glands and endometrial stroma are prominent. In large chocolate cysts, the epithelium lining is thinned by pressure, and the stroma is scanty or absent. Endometrium growing in smooth muscle, such as the uterus and its ligaments, simulates the proliferation of smooth muscle, which grows in whorls between the bits of endometrial tissue—frequently histologically, resembling internal adenomyosis.

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In many instances, the glands and the stroma go through the normal cyclic changes, as does the endometrium in its normal site. During pregnancy a full decidual reaction is frequently noted. However, in some lesions the endometrial pattern may be purely proliferative, showing no gestational change.<sup>2</sup>

### SURGICAL PATHOLOGY

The consistency and appearance of the lesions of endometriosis vary greatly according to location and duration. The rust or tar-colored-puckering surface lesion is typical, involving serosa of uterus, bladder, cul-de-sac, bowel, or ovary. Some of these lesions have the appearance of black gunpowder burns. The shotty induration of the posterior surface of the uterus, cul-de-sac, and uterosacral ligaments is typical. All of these findings may be present in the same case with a resulting, so called, frozen pelvis. The ovarian cysts at times fuse together by adhesions in the cul-de-sac. Irregular grayish-yellow lesions with islands of tar-colored implants in the interior, apparent on sectioning, involving the wall of the rectum, sigmoid, bladder, or inguinal canal, frequently simulate carcinoma. The endometriosis lesions are usually of much harder consistency than carcinoma, and the bowel or bladder mucosa, on palpation, may feel normal over the lesion which is invading from without.

Blue-black cysts in an operative scar, umbilicus, or on the cervix, are usually endometriosis. If the lesion simulating carcinoma is found to be progressing or has made its appearance postmenopausally, carcinoma is a certainty. Bleeding lesions from within the bowel or bladder can only be differentiated from carcinoma, with certainty, by biopsy. Obstructing lesions of the sigmoid, while not frequent, are not a rarity. To rule out carcinoma, biopsy is a must.

### SYMPTOMATOLOGY, SIGNS, AND DIAGNOSTIC HINTS

The symptomatology of a series of 101 cases reported by Hilton<sup>3</sup> of both *external* and *internal* endometriosis is illustrated in table 2.



TABLE 1

*Distribution of external endometriosis in 569 cases*

Location	No. of Cases
Ovaries.....	343
Uterus.....	313
Cul-de-sac.....	191
Ligaments of the uterus.....	69
Sigmoid.....	8
Rectum.....	14
Tube.....	16
Abdomen.....	3
Bladder.....	3

TABLE 2

*Symptomatology of 101 cases of Hilton*

Symptom	Internal Endometriosis	External Endometriosis	Total
Infertility.....	11	27	38
Menorrhagia.....	15	17	32
Pelvic pain.....	8	20	28
Abdominal pain.....	5	18	23
Dysmenorrhea.....	3	19	22
Menometrorrhagia.....	12	3	15
Dyspareunia.....	3	7	10
Metrorrhagia.....	2	4	6
Backache.....	3	1	4
Bladder symptoms.....	1	3	4
Rectal pain.....	0	2	2

Pain is the most prominent and troublesome symptom. Acquired dysmenorrhea in the third or fourth decade is a signal to start looking for endometriosis. Hard, palpable, tender lesions in the inguinal canal or external genitalia, which become much more painful during menstruation, are usually endometriomas. Bleeding from the bowel or bladder, only at menstrual time, is suggestive of endometriosis. Tender, palpable lesions in the cul-de-sac in a woman who has recently acquired dyspareunia, low backache, and low abdominal pain with acute exacerbation at menstrual time, is almost sure to be endometriosis.

## HISTOGENESIS

It is well established, through our knowledge of physiology and histology of reproduction, that these lesions are of Müllerian origin, since they show all variations of response to the ovarian hormones characteristic of endometrium, in its normal site. Sampson's implantation theory seems

logical and is accepted by many; however, there are also noteworthy objections to his theory. The problem really has not been solved.

Gootlieb<sup>2</sup> reported 100 cases of endometriosis in the operative scars following hysterotomy abortion. Of the 72 patients displaying symptoms, only three had pain in the first year after operation. This report tends to substantiate the implantation theory.

Forkner and associates<sup>1</sup> demonstrated that an endometrioma is a benign tumor that metastasizes much in the same manner as does endometrial carcinoma, by way of both blood vessels and lymphatic channels; they pointed out that, after an area of endometriosis is established in the ovary, on the peritoneum, or elsewhere, this mass acts as another focal point from which secondary benign metastases may spread.

The author recently operated a case, who had been operated elsewhere several years ago because of an ectopic pregnancy of the left tube. In addition to the multiple uterine fibroids for which the author operated, the patient had a walnut size endometrioma involving the dome of the bladder on the left side. There was no other gross evidence of endometriosis in the pelvis. The lesion was possibly implanted at the time of her ruptured tubal pregnancy.

## TREATMENT

Three forms of therapy are generally employed—namely x-ray, endocrine and surgical.

Meschan<sup>7</sup> points out that control of menstruation is the primary purpose of x-ray therapy in endometriosis; and in his opinion, should be reserved for use as an adjunct to surgery. That is, in those in whom, because of their poor general condition or the extensiveness of the disease, the desired surgery could not be accomplished. I would add that, in some cases, it may be desirable to administer x-ray therapy, rather than do a second operation, for those who had not responded to conservative surgery.

Endocrine therapy has its advocates. Masters<sup>6</sup> states that,

"In so far as the management of endometriosis with heavy estrogen repression therapy is concerned, we feel that this technique has an advantage in modest to minimal endometriosis involvement. In advanced cases, such as chocolate cyst, etc., we have found no satisfactory return

from attempts to produce retrogression. It has also been interesting to note that in many situations where heavy estrogen therapy has been used for endometrial involvement of the cul-de-sac, the pain complex disappeared even though the local implants have not shrunk in size."

In those cases not far enough advanced to require surgery, but where pain has become a troublesome factor, and in some cases of young women on whom the author has done conservative surgery, androgen therapy has definitely been worthwhile. Masculinizing changes can usually be avoided, if the dosage is kept below 250 mg. of testosterone per month for not more than three consecutive months.

After making a recent study, Greenblatt and Jungck<sup>3</sup> make the following observations:

"Norethindrone (norethisterone), 17-a-ethinyl 19-nortestosterone, a new oral progestational compound, has been found to be an active orally given progesterone-like compound. In a daily oral dose of 20 to 30 mg. this compound will delay a normal menstrual period, even if treatment is begun seven days after ovulation. A dose of 20 to 30 mg. daily is sufficient to induce a pseudopregnancy of up to seven months' duration and longer.

The significance of this preparation becomes readily apparent. In endometriosis, when painful menses is a problem, the patient can be kept free from pain for many months. In most patients with endometriosis on prolonged norethindrone therapy, the chronic lower abdominal pain has disappeared, dyspareunia has been alleviated, and a striking softening of the pelvic structures with regression of the palpable cysts and nodules was noted on pelvic examination. When norethindrone was discontinued after three months of treatment, prompt return of the symptomatology usually occurred. Longer courses of norethindrone therapy are now being evaluated, and it appears that more lasting benefits accrue to those on therapy for six months or longer."

Surgery is the treatment of choice in the majority of cases of moderate to advanced endometriosis. The question as to whether one should do conservative or radical surgery depends on whether the objective is control or cure.

In young women, even though the disease is moderately extensive, an attempt should be made to salvage some ovarian tissue, knowing full well that further treatment (even surgery) may become necessary in the future. This is especially true in women who wish to become pregnant, since a small percentage of previously sterile women do conceive following surgery.

Frequently, the uterus is hopelessly involved and a total hysterectomy should be done; however, even in these cases, it is often possible to save one or both ovaries.

Isolated large lesions, such as one sometimes finds in the inguinal canal and external genitalia, should be excised.

Extensive lesions of the bowel and bladder should be biopsied to rule out malignancy. Definitive surgery can then be planned.

In extensive pelvic endometriosis involving ovaries and uterus, a total hysterectomy and bilateral salpingo-oophorectomy should be done. In the very young, conservatism should be considered.

Obstructing lesions of the bowel, like other obstructing lesions, require either resection, or transverse colostomy. In these cases it is, of course, important to know whether one is dealing with endometriosis or carcinoma. If the patient is only partially obstructed, it is probably desirable, except in young women, to remove both ovaries and leave the bowel alone.

Endometriosis, occurring elsewhere in the body, must be individualized in so far as the type of surgery to be employed is concerned. It would be far better, for instance, to remove both ovaries than to remove a kidney or a large portion of a lung. Endometriosis has been found in both organs.

#### CASE REPORTS

Abstracts of the operative records of five cases of endometriosis operated at the Hawkins Clinic Hospital during February and March, 1958, are being presented to illustrate five different types of pathology, each requiring a different surgical procedure.

##### *Mrs. P. Case Number 156-58*

*Preoperative history.* This 26-year-old white female has had postmenstrual pelvic pain for the past 18 months. It has been worse for the last 2 weeks. Dyspareunia has been present for several months. She has been married 1½ years, and there has been no pregnancy. Surgery was advised about a year ago because of the presence of a pelvic mass; however, she postponed surgery to complete her studies for a college degree.

*Operation.* On February 7, 1958, the operation was performed. Upon opening the abdomen, there was gross evidence of endometriosis involving all of the pelvic organs. Both ovaries contained chocolate cysts and were fused together by ad-

hesions, posterior to the uterus in the cul-de-sac. The right ovary was the size of an orange, and the left the size of a lemon.

The uterus and ovaries were mobilized and a right oophorectomy was done. The cystic portion of the left ovary was excised leaving a small section of apparently normal ovarian tissue. A routine appendectomy was done. Before closing, a large Meckel's diverticulum was found and was excised. No other pathology was found.

*Postoperative diagnosis.* The postoperative diagnosis was endometriosis of both ovaries, posterior wall of the uterus, and cul-de-sac.

*Comment.* Because of this woman's youth and her desire for a pregnancy, conservative surgery was carried out. A large enough percentage of previously sterile women conceive, following conservative surgery for endometriosis, to justify the attempt, even though further treatment will likely become necessary.

*Mrs. B. Case Number 214-58*

*Preoperative History.* This 34-year-old white female had pain in her abdomen for several years; the pain became worse within the six weeks prior to examination—more noticeable in the left pelvis. She stated that the pain had been no worse at menstrual time—menses scanty up to one year previously, profuse since. She has never been pregnant.

*Preoperative diagnosis.* The preoperative diagnosis was multiple uterine fibroids.

*Operation.* On February 19, 1958, the operation was performed. Upon opening the abdomen, the uterus was found to be enlarged and contained multiple fibroids. There was gross evidence of endometriosis in the posterior wall of the uterus, in the cul-de-sac and uterosacral ligaments, as manifested by a shotty feel and fixation of the tissues. There was also a small implant in the adjacent anterior wall of the rectum which did not involve the mucosa of the bowel. The ovaries appeared healthy. There was no other pathology found within the abdomen.

A total hysterectomy was done. The ovaries were suspended to the adjacent round ligaments. A routine appendectomy was done.

*Postoperative diagnosis.* The postoperative diagnosis consisted of (1) multiple uterine fibroids, and (2) endometriosis of the uterus, cul-de-sac, and anterior rectal wall.

*Comment.* Further trouble because of endometriosis is possible but not likely. Because of her youth, her ovaries were left. It was explained to the patient and her husband that the ovaries

were preserved at the cost of possible future x-ray therapy or further surgery.

*Mrs. H. Case Number 225-58*

*Preoperative history.* This 43-year-old gravida 4, para 3, white female discovered a hard mass in the right inguinal region about five months ago. The mass was especially painful and tender during menstruation and was associated with lower abdominal pain. Previously, she had had mild dysmenorrhea for four or five years. Pelvic examination was essentially negative, except for cervicitis. No gross evidence of pelvic endometriosis was found.

*Preoperative diagnosis.* The preoperative diagnosis was probable endometrioma of the right inguinal canal.

*Operation.* On February 20, 1958, the operation was performed. Upon opening the right inguinal canal, the hard walnut-sized tumor mass was found to be densely adhered to the round ligament and surrounding structures in the distal end of the canal. A right indirect inguinal hernia, obscured by the mass in the canal preoperatively, was found to be present.

The walnut-sized tumor mass was excised and the hernia was repaired. The right ovary could be seen through the opened hernial sac: it contained only a small simple cyst which was not disturbed. No gross evidence of endometriosis could be palpated through the hernial opening.

*Postoperative diagnosis.* The postoperative diagnosis was (1) inguinal hernia, and (2) walnut-sized endometrioma of the round ligament in the right inguinal canal. The tumor had a hard granular feel, and on sectioning, was grayish-yellow with some areas of tarry blood present.

*Histological findings.* Microscopic sections from the lesion from the inguinal canal showed a basic structure of fibrous tissue. These connective tissue cells are very thin and elongated and spindle-like. They occur often in nests and they support a number of glands. These glands in some areas resemble the glands of the endometrium, and they are, also, supported by endometrial stroma.

*Comment.* Except for biopsy and conization of the cervix, no further treatment will likely be indicated. If her dysmenorrhea becomes severe, androgen therapy will be given a trial.

*Mrs. S. Case Number 231-58*

*Preoperative history.* This 36-year-old white female has had dysmenorrhea since onset of menses at age twelve. Her dysmenorrhea has been less severe during the past six months. She has had dyspareunia all of her married life, since age eighteen. She was gravida 2, para 2. Her first

pregnancy occurred six years after marriage. She had brownish vaginal discharge for one year.

*Preoperative diagnosis.* The preoperative diagnosis was a pelvic tumor, and a probable left ovarian cyst.

*Operation.* On February 21, 1958, the operation was performed. Upon opening the abdomen, all pelvic structures were found to be bound down into the cul-de-sac, typifying the, so called, frozen pelvis. Both ovaries contained large chocolate cysts. Gross pelvic endometriosis was apparent. There was also a deforming endometrioma of the appendix. No other pathology was found within the abdomen.

A total hysterectomy, bilateral salpingo-oophorectomy, and appendectomy was done.

*Postoperative diagnosis.* The postoperative diagnosis was extensive endometriosis involving both ovaries, uterus, cul-de-sac, uterine ligaments, and appendix.

*Comment.* Both ovaries were totally destroyed, which likely accounts for the diminishing dysmenorrhea during the past six months. No further treatment is contemplated in this patient.

#### Mrs. W. Case Number 289-58

*Preoperative history.* This 43-year-old white female has had pain from time to time when voiding. She has had soreness and pain in the lower abdomen for several months. Dyspareunia has been present. There has been no significant relationship between the patient's pain and menstruation. This patient has been pregnant three times and aborted early in each pregnancy. She has never carried a pregnancy to term. The patient had an ectopic pregnancy several years ago. At that time, the left tube and ovary were removed.

*Preoperative diagnosis.* The preoperative diagnosis was multiple uterine fibroids.

*Operation.* On March 6, 1958, the operation was performed. Upon opening the abdomen, the uterus was found to be enlarged by approximately seven times normal size with multiple uterine fibroids of all descriptions. A hard walnut-sized tumor of the wall of the dome of the bladder on the left side was palpable. A fold of bladder peritoneum was attached to the peritoneum over the tumor. There was no apparent induration of the adjacent bladder wall. There was no gross evidence of endometriosis elsewhere in the abdomen. The left tube and ovary were missing. The right ovary was normal. The appendix had been removed.

A total hysterectomy was done. The right ovary was suspended to the right round ligament.

The bladder tumor with attached bladder mu-

cosa was excised. The tumor could not be dissected from the mucosa. The bladder wall was closed with two inner layers of catgut and an outer layer of silk.

*Postoperative diagnosis.* The postoperative diagnosis consisted of (1) multiple uterine fibroids, and (2) walnut-sized endometrioma of the dome of the bladder. On sectioning, the bladder tumor was found to be hard, grayish-yellow in appearance with islands forming pools of tar-colored blood throughout.

*Histological findings.* Review of the sections taken from the lesion from the bladder show definite groups of endometrial glands, stromal areas, and zones of hemorrhage. In addition, there is a small area of hemangiomatous activity possibly in relationship to the rather extensive amount of endometriosis that is evident.

*Comment.* No further treatment is contemplated.

#### SUMMARY

The subject of endometriosis is reviewed. Five different types of cases, requiring five different types of surgical procedure, are presented.

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#### REFERENCES

1. FORKNER, C. E., FROST, I., GREELEY, A. V., AND JAVERT, C.: Endometriosis. Practitioners' Conference, New York Hospital-Cornell Medical Center. New York Med., 13: 574, 1957.
2. GOOTLIEB, T.: Endometriosis in the vaginal scar following hysterotomy for therapeutic abortion. Acta obst. et gynec. scandinav., 36: 194, 1957.
3. GREENBLATT, R. B., AND JUNGCK, E. C.: Delay of menstruation with norethindrone, an orally given progestational compound. J. A. M. A., 166: 1461, 1958.
4. HAYDEN, G. B.: A study of 569 cases of endometriosis. Am. J. Obst. & Gynec., 43: 704, 1942.
5. HILTON, H. D.: Pelvic endometriosis: a review of 101 consecutive cases. Nebraska M. J., 42: 159, 1957.
6. MASTERS, W. H.: Department of Obstetrics and Gynecology, Washington University School of Medicine, St. Louis. Personal communication.
7. MESCHAN, I., Professor and Director, Department of Radiology, Wake Forrest College, Bowman Gray School of Medicine, Winston-Salem, North Carolina. Personal communication.
8. TE LINDE, R. W.: *Operative Gynecology*, p. 416. J. B. Lippincott Company, Philadelphia, 1957.

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## STASIS ULCER

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The pathogenesis of stasis ulcer is a controversial subject due to the poor understanding of the phlebodynamics of the lower extremity.<sup>5</sup> Etiological factors must be determined before proper therapy can be instituted. The various types of recommended local medication attest to the poor concept of the basic pathology.

Stasis ulcer usually coexists with incompetent superficial veins or thrombotic deep veins. A small percentage of ulcers develop without the existence of these two pathologic factors. Ulcers may also result from other etiologic factors, such as arteriosclerosis, trauma, obesity, malignancy, glandular deficiency, infection (specific or non-specific), neurogenic disorders, nutritional disturbances, sickle cell anemia, or arteriovenous fistula.

Stasis ulcer results from a state of ambulatory venous hypertension that is secondary to irreversible damage to the superficial, deep, and communicating veins of the lower extremity.<sup>10</sup> If the underlying cause of the ulcer is a high postural venous pressure, the skin will break down unless the incompetent perforators are eliminated.

A precursory ulcer may be manifested by a spray of fine dilated venules, which spread over the inner surface of the ankle, behind the ankle, and flares out to be lost in the thick skin of the heel pad.<sup>4</sup>

When the valves of the communicating veins are rendered incompetent as occurs in superficial or deep vein thrombosis, there is a reversal of flow from the deep to the superficial system, following recanalization of the deep veins. Contraction of the calf muscle creates a rise in pressure with resultant transmission to the network of subcutaneous veins, and subsequent ulceration.

Chronic ulcer of the leg is apparently associated with local rather than generalized stasis of the circulation. Intradermally injected radio-sodium is taken up more rapidly by venous channels in patients with chronic leg ulcers than in healthy persons.<sup>2</sup>

Rational therapy is based on a sound understanding of the anatomic and physio-pathologic

factors responsible for the arterial and venous circulation of the lower extremities.

### ANATOMY OF THE VENOUS SYSTEM OF THE LOWER EXTREMITY

The venous system is made up of three tributaries which are intimately associated with the lymphatics that drain the tissue fluid of the extremity.

1. The superficial system (internal and external saphenous) and their tributaries have bicuspid valves that permit blood flow cephalad.

The great saphenous vein is superficial, and gives off branches that are thinner walled with a tendency to dilate. At the level of the knee, there are anterior and posterior branches anastomosing with the popliteal vein, and a posterior branch anastomosing with the perforating veins. Below the ankle, the terminal branches anastomose with branches of the anterior and posterior tibial veins.

The small saphenous vein courses from the lateral malleolus to the popliteal fossa and anastomoses with the lateral perforating vein in the lower third of the calf.

2. The deep system (common, superficial, deep femoral, popliteal, anterior, posterior tibial, and peroneal) has bicuspid valves that permit blood flow cephalad.

There are wide variations in the anatomy of the femoral and popliteal veins. There is a constant anastomosis between the femoral and profunda veins at the adductor canal.<sup>4</sup>

The posterior tibial veins in the lower third receive the two muscular veins from the soleus, and also receive two large perforating veins which perforate the deep fascia of the leg and drain the subcutaneous tissues about the internal malleolus.

The soleus muscle has a series of large venous sinuses without valves that drain by a series of short veins into the posterior tibial and peroneal veins.

The gastrocnemius muscle is drained by a single large vein that enters the popliteal vein in the lower part of the popliteal fossa.

3. The communicating veins have bicuspid valves that permit blood flow from the super-



ficial to the deep veins. These veins link the femoral and long saphenous veins in the thigh, and the deep and superficial systems in the leg. Three veins in the leg perforate the deep fascia and empty into the posterior tibial veins.

From the thin walled venous arch connecting the perforating veins to each other, and from the perforators themselves, numerous small delicate vessels drain the subcutaneous tissues. The venous drainage of the ulcer bearing area is directly into the deep veins by the three large perforating veins on the inner side and the one large perforator on the outer side of the leg. Incompetence of the saphenous system can also reach this same area by the large posterior arch vein arising from the saphenous vein at the level of the knee.<sup>21</sup>

#### DYNAMICS OF THE VENOUS SYSTEM

In the erect position, the return of blood from a dependent area is opposed by the gravitational force of a column of blood from that area to the heart level. Such a gravitational force interferes with the venous return unless accessory factors prevent orthostatic venous stasis.

1. The valves in the subcutaneous veins break the continuous column of the blood stream, carry the weight of the column above, and allow flow of blood to the heart. The hydrostatic column pressure is prevented from reversing and exerting pressure against the peripheral veins and capillaries.

2. The deep fascia forms a firm investing layer for the calf muscles to act as a peripheral venous pump. When the muscles contract, the deep veins are compressed and blood is squeezed cephalad with considerable force, thereby facilitating the return flow to the heart in the erect position. When the muscles relax, the deep veins are emptied and at low pressure so that blood flows in from the superficial veins. The deep veins and lymphatics in the muscular compartment benefit by the propulsion of the arterial current, and sucking action created by joint motion. The squeezing action of muscular contraction creates a propulsive force to assist antigravitational flow of venous blood and lymph. The superficial veins benefit from the transmitted impulse of muscular contraction indirectly, as the pressure of expanding muscles pin the overlying veins against the skin.

3. The valves in the perforator veins prevent

retrograde flow from the deep veins into the subcutaneous veins. Contraction and relaxation of the calf muscles, pumps blood cephalad against gravity directly from the deep veins, and indirectly from the subcutaneous veins by way of the perforator veins.

Valvular incompetence permits venous reflex with resultant increase in the capillary hydrostatic pressure. Proteins diffuse into the tissues and inadequate lymphatic drainage produces edema, stimulates fibrosis and serves as a culture media for infection.

The degree of incompetency seems to be related to the muscular and fascial support given to the veins.<sup>14</sup>

The skin over the lower third of the leg is immobile and the basic blood supply to the soft tissues is poor. The superficial veins receive little external support and become dilated and incompetent from the increased pressure in the post-phlebotic leg.

The internal saphenous vein is the most common channel of stagnation as it supports a heavy column of blood and receives no muscle support. Emptying of the lower end of the vein is aided by ankle joint motion.

#### PATHOLOGY

Increased venous hydrostatic pressure results in local edema which slows the exchange of oxygen and metabolites, thereby interfering with cellular nutrition, and rendering tissues more vulnerable to trauma.

The progressive pathology of venous stasis results in edema, cellulitis, fibrosis, pigmentation, dermatitis, phlebitis, and ulceration.

Venous stasis results in a loss of fluid through the capillary wall, accumulation of extracellular fluid, diapedesis of red blood cells, deposits of hemosiderin and pigmentation of the skin. Petechial hemorrhages occur from the rupture of venules. Eczema varying from a mild to a severe inflammatory type results from the nutritional changes in the skin. Trauma, passive congestion, and tissue anoxia contribute to the breakdown of the skin.

The periulcerative process is characterized by hypertrophy and collagenous degeneration of the investing fascia and muscle. Cellular infiltration takes place in the ulcer margin as well as in the base of the ulcer. There is perivascular infiltration of lymphocytes and plasma cells with compression

of arterioles and venules, perineural inflammatory fibroses, hypertrophy and fibrosis of the dermis and epidermal atrophy. Bacterial invasion leads to necrosis and loss of epidermis.<sup>6</sup>

Fibrosis of the subcutaneous tissue blocks lymphatic drainage of the protein rich tissue fluid from the ulcer. The fibrosis also blunts the impulses of muscular contraction transmitted through the deep fascia. The veins fail to be flattened against the skin and empty themselves. As fibrosis progresses, local blood supply and tissue nutrition diminish, so that the slightest trauma or infection produces ulceration.

The sural, musculo-cutaneous and saphenous nerves may become involved in the inflammatory induration surrounding the ulcer.

Varicose ulcer usually occurs where the hydrostatic pressure and stagnation of fluid is most marked. These ulcers are shallow, less than an inch in diameter and rarely penetrate the deep fascia. Feeding veins enter the ulcer and the adjacent skin exhibits stasis pigmentation.

Postphlebotic ulcers usually occur as a result of destruction of the valves of the deep and communicating veins. A state of ambulatory venous hypertension impairs the efficiency of the venous return from the lower extremity. As the venous hypertension persists, varicosities of the communicating and superficial veins occur.<sup>10</sup> Development of the ulcer following thrombosis is delayed until recanalization is far advanced. The deep veins recanalize, but the valves are destroyed and rendered incompetent. Ulcer formation is attributed to the retrograde blood flow in varicose veins due to gravity.<sup>11</sup>

Superficial thrombo-phlebitis and lymphedema superimposed on an area of chronic stasis frequently results in ulceration. Lymphedema itself rarely leads to chronic ulceration of the skin.

Postphlebotic ulcers penetrate the fascia. Fibrosis of the floor of the ulcer encircles the limb with a broad band of avascular tissue.

Arteriosclerotic ulcers usually penetrate the fascia and may expose muscles and tendons. Small ulcers may coalesce and form a large ulcer. This is usually infected and covered by gangrenous, foul smelling tissue over the anterolateral aspect of the leg or foot.<sup>12</sup>

#### VENOUS PRESSURE

A study of the venous pressure in the superficial veins at rest and following exercise imparts

valuable information as to the pathologic state arising from venous incompetency of the lower extremity.<sup>7</sup>

The standing venous pressure at the ankle is about 100 to 200 mm. of Hg, indicating the great pressure to which the walls of these veins are subjected. There is a reduction in the standing venous pressure during ambulation due to the pumping action of the venous heart of the lower extremity. Venous pressure falls after exercise to between 10 and 20 mm. Hg.<sup>3</sup> There is no great change of pressure in the deep veins following exercise.

If the valves are incompetent, the rise of pressure on every contraction of the calf muscles can be transmitted directly to the delicate venous mesh with which they are connected. Gradual dilatation occurs in the small venules in this area.

Venous pressure within the calf muscles is greatest in the lower third of the leg where the perforating veins enter.

*Venography.* Venography is utilized to determine the patency of the popliteal and femoral veins, their valves, and the presence of incompetent perforating veins.

#### THERAPY

Treatment may comprise one or a combination of the following:

1. *Local therapy.* The use of local medication *per se* will not effect permanent healing stasis ulcers. Local medication should be simple to apply, nontoxic and nonsensitizing.

2. *Elevation and compression.* It has been estimated that the minimum metabolic needs of the skin amounts to 1-2 ml. of fresh arterial blood per 100 ml. of tissue per min. This is a very small requirement indeed, and it can be realized that the blood supply of the skin must practically be cut off before necrosis occurs. An ulcer usually will heal when the blood supply to the limb improves. The horizontal position aids the return flow against gravity, and continuous elevation may eliminate the edema. Active and passive exercises may expedite the reduction of edema.

Compression of the lower extremity by elastic supportive bandages re-establishes the function of the venous heart of the lower extremity.

Various dressings have been utilized to compress the superficial veins around and beneath the ulcer and prevent pooling into the subcutaneous venous channels. Such a pressure mecha-

nism reduces lymphedema by forcing lymph cephalad. An elastic support forces venous flow into the deeper system. The deep veins thereby facilitate the return flow with reduction of pressure on the superficial veins.

Many types of pressure dressings have been advocated. Unna's paste boot and its modifications prevents excessive secretion by external support and temporarily eliminates incompetent superficial veins and valves.<sup>12, 18</sup>

### 3. Surgical ligation and vein stripping.<sup>15-17</sup>

4. *Excision of ulcer and skin grafting.* The indurated ulcer may require block excision of pathologic tissue.<sup>8</sup> Excision includes the base of the ulcer with surrounding inelastic skin, thickened fascia, and necrotic tissue.

Primary covering of the defect is performed with a thick partial thickness skin graft. A full thickness graft may be preferable over the medial malleolus.<sup>19, 20</sup> A pedicle graft (direct or tubed) may be used for deep ulcers that have exposed bone or tendon. Secondary grafting may be utilized.

Lee<sup>9</sup> has advocated darning the ulcerated area with skin. Skin strips are darned in and out of the granulation in the floor of the ulcer. More of the graft is placed under the granulation than upon the surface because the buried portion of the graft is more likely to survive.

5. *Fascial stripping.* Tissue fluids cannot drain cephalad through scarred subcutaneous tissues unless the fascia is excised. Removal of fibrous tissue around the ulcer permits muscle tissue to come in direct contact with the skin. Muscular contractions aid the sluggish lymphatics and venous flow within the subcutaneous space.

6. *Saphenous neurectomy.* Saphenous neurectomy may be indicated for saphenous neuritis.<sup>1</sup>

7. *Sympathectomy.* High lumbar sympathectomy can be utilized in recurrent ulcers when the foot is cold and blue, pulses poor, sweating excessive and when novacaine lumbar sympathetic block produces a rapid and marked rise in skin temperature and improvement in color.<sup>17</sup>

### SUMMARY

The phlebodynamics of the lower extremity and pathogenesis of stasis ulcer are controversial subjects. The treatment of stasis ulcer is not standardized. Stasis ulcer is best treated by various combinations of the following methods

depending upon the severity of the lesion: (1) local therapy, (2) elevation, exercise, and compression of the extremity, (3) surgical vein ligation and vein stripping, (4) surgical excision of the ulcer and skin grafting, (5) fascial stripping, (6) saphenous neurectomy, and (7) sympathectomy.

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### REFERENCES

1. ATLAS, L. N.: Resection of the saphenous nerve in selected cases of painful stasis ulceration of the leg. *West. J. Surg.*, 62: 395, 1954.
2. BLOCKER, T. G., JR., LEWIS, S. R., PERRY, J. E., TUMBUSCH, W. T., AND LYNN, W. L.: Rate of disappearance of intradermally injected radiosodium as an index of blood flow in normal and chronically ulcerated legs. *Ann. Surg.*, 145: 630, 1957.
3. BOYD, A. M., JEPSON, R. P., RATCLIFFE, A. H., AND ROSE, S. S.: Logical management of chronic ulcers of leg. *Angiology*, 3: 207, 1952.
4. COCKETT, F. B.: Pathology and treatment of venous ulcers of the leg. *Brit. J. Surg.*, 43: 260, 1955.
5. FELL, S. C., MCINTOSH, H. D., HORNSBY, A. T., HORTON, G. E., WARREN, J. V., AND PICKRELL, K.: Syndrome of the chronic leg ulcer. *Surgery*, 38: 771, 1955.
6. HELLER, R. E.: Pathology and treatment of indolent ulcers of the leg. *Surg. Gynec. & Obst.*, 76: 77, 1943.
7. JOHNSON, G. F.: Venography and surgery of postphlebotic syndrome. *Surg. Gynec. & Obst.*, 101: 9, 1955.
8. LEWIS, G. K., AND WERELIUS, C. Y.: Surgical treatment of chronic ulcers of the leg. *Am. J. Surg.*, 91: 396, 1956.
9. LEE, M.: Varicose ulcers. *Practitioner*, 170: 288, 1953.
10. LINTON, R. R.: Post-thrombotic ulceration of the lower extremity. *Ann. Surg.*, 138: 415, 1953.
11. LOCKHART-MUMMERY, H. E., AND SMITHAM, J. H.: Varicose ulcer. Study of deep veins with special reference to retrograde venography. *Brit. J. Surg.*, 38: 248, 1951.
12. MILBERG, I. L., AND TOLMACH, J. A.: Treatment of chronic leg ulcers with absorbable gelatin sponge (gelfoam) powder. *J. A. M. A.*, 165: 1219, 1954.
13. MOYER, C. A., AND BUTCHER, H. R., JR.: Stasis ulcers. *Ann. Surg.*, 141: 577, 1955.
14. MURPHY, T. O., AND FELDER, D. A.: Phlebographic pathology of the postphlebotic limb. *Surgery*, 37: 873, 1955.
15. MYERS, T. T.: Results and technique of stripping operations for varicose veins. *J. A. M. A.*, 163: 87, 1957.
16. MYERS, T. T.: Manifestation of varicose veins with special reference to the stripping operation. *S. Clin. North America*, 35: 1147, 1955.
17. RUTTER, A. G.: Chronic ulcer of the leg in

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18. SCOTT, W. J. M.: Postphlebitic and varicose vein stasis. Postgrad. Med., 14: 494, 1953.
19. STALKER, L. K.: Symposium on ambulant surgery: management of varicose veins and varicose ulcers. S. Clin. North America, 33: 1245, 1953.

20. TOTTEN, H. P.: Postphlebitic leg. J. Internat. Coll. Surgeons., 27: 18, 1957.
21. WELLS, H. S., YOUNMAN, J. B., AND MILLER, D. G., JR.: Tissue pressure (intracutaneous, subcutaneous and intramuscular) as related to venous pressure, capillary filtration and other factors. J. Clin. Invest., 17: 489, 1938.

## CONGENITAL TRACHEOESOPHAGEAL FISTULA WITHOUT ATRESIA OF THE ESOPHAGUS

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Congenital tracheoesophageal or bronchoesophageal fistula without atresia of the esophagus is a rare anomaly. Untreated, it may result in death in the first few days, weeks, or months of life, or may result in years of serious respiratory difficulties. Because of the rarity of this condition and the difficulties in establishing the diagnosis, operative correction has been employed infrequently. We wish to report three cases of congenital tracheoesophageal fistula and one case of bronchoesophageal fistula which we have treated surgically.

### CASE REPORTS

*Case 1.* J. E., an 8-year-old girl was admitted to Mercy Hospital on May 18, 1947, with the history of a chronic cough since infancy. During her early years of life, she had had severe coughing and choking, and her chest filled with bubbling rales following each attempt at feeding. She spent the first 7 months of her life in the hospital with most of her feedings given by gavage. On two occasions, esophagrams were made with thin barium mixture and were interpreted as showing no evidence of tracheoesophageal fistula. We were able to obtain one of these x-rays made April 21, 1939 (fig. 1) which shows a good bronchogram from the lipiodol injected into the esophagus. At the age of 14 months she was examined endoscopically at Children's Memorial Hospital in Chicago and the parents were told that an opening was seen between the esophagus and trachea. She continued to have frequent episodes of aspiration pneumonia and was hospitalized for long periods on numerous occasions. Some of these clinical records were reviewed and the notes contained many references to marked abdominal distention and the inevitable coughing which accompanied eating.

So far as we were able to ascertain, no one had ever suggested to the parents that surgical closure of the fistula be attempted. Examination on admission to Mercy Hospital showed a tall, thin girl, estimated to be about 20 pounds below her expected weight. There were coarse rales over both lung fields. On bronchoscopic examination, the

fistula was not seen and there was much purulent material in the right lower lobe bronchus. A right bronchogram failed to reveal the fistula and no bronchiectasis was present. A right posterolateral thoracotomy was done on May 24. There were a few adhesions between the upper lobe and the chest wall. The esophagus was mobilized and at the level of the third rib posteriorly, the trachea and esophagus were attached over a distance of 2 cm. This area of attachment appeared to represent a common party wall. In the lower portion of this area, there was an opening 4-mm. in diameter between the two structures.

The openings in the trachea and esophagus were each closed with interrupted fine silk sutures, and a pleural flap sutured over each of the suture lines. The postoperative course was uneventful; the nasogastric tube being removed on the sixth day, and a liquid diet started. She was dismissed from the hospital 16 days following operation. She had no dysphagia, was eating a normal diet, and in that short time had gained 4 pounds in weight.

*Case 2.* L. B., a 3-day-old female infant was first admitted to the Children's Hospital February 21, 1950, with the history of coughing and cyanosis on attempts at feeding. No fistula was seen on tracheoscopy or esophagoscopy. Methylene blue was instilled into the trachea and observation through an esophagoscope failed to show any of the dye in the esophagus. An esophagram with the patient in the prone position did not reveal a fistula between the esophagus and the trachea. On fluoroscopic examination, incoordination of the swallowing mechanism was noted and there was also free regurgitation of the contrast media from the stomach into the esophagus. Because of the continued difficulty associated with feedings, a gastrostomy for feeding purposes was constructed on March 2. Feedings were given through the gastrostomy opening for the following year and were well tolerated. For the next two years the child got along fairly well, although she continued to have occasional coughing and choking while eating. She was again seen in March 1954 and her mother stated that the child had awakened from sleep on four occasions during the previous four months with severe coughing and dyspnea, and had become cyanotic on each occasion. An esopha-

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gram in the prone position again failed to demonstrate a tracheoesophageal fistula. An inflated balloon was placed in the lower esophagus and iodized oil injected into the esophagus. Some oil entered the trachea, but the child coughed and struggled so much that the fluoroscopist could not determine with certainty whether the oil entered the trachea through the larynx or through a fistulous tract. On March 10, at operation through a right posterolateral thoracotomy incision, a tracheoesophageal fistula, 4 mm. in diameter, was found entering the trachea 3 cm. above its bifurcation. This was divided and the openings in the trachea and esophagus closed with interrupted fine silk sutures. On removing the intratracheal tube, following the completion of the operation, cardiac arrest occurred. The chest incision was re-opened and the heart beat restored by intermittent compression of the heart. The child continued to show signs of shock, however, and died five hours later. Postmortem examination of the lungs showed scattered small foci of acute bronchopneumonia and striking interstitial fibrosis

with numerous granulomas. Some of these granulomas consisted of multinucleated giant cells containing highly refractile crystalline material; others were well laminated fibrous tissue structures containing sickle-shaped, refractile Schiff positive material. One granuloma consisted of radially arranged epithelioid cells surrounding large thick-walled vegetable cells.

*Case 3.* J. S., a 15-year-old girl was admitted to General Rose Memorial Hospital April 22, 1956, with a history of a chronic productive cough since birth. X-ray of the chest showed atelectasis and consolidation in the lower half of the right lung. Bronchoscopy was performed April 23, and when the instrument was passed into the trachea, the patient retched and strained, and a large amount of purulent material appeared in the trachea. Midway between the glottis and the tracheal bifurcation, an opening in the posterior aspect of the trachea was seen. At the time, this was thought to be an anomalous origin of a bronchus. Dionosil was injected into a catheter placed in this opening and subsequent x-rays revealed



Fig. 1 (case 1). Lipiodol injected into esophagus enters trachea through fistula. The lipiodol in stomach proves patency of esophagus.

all the Dionosil in the stomach. On further questioning, the parents gave the additional history that the child had no difficulty with feedings the first few days after birth, but she then began to have frequent episodes of choking and cyanosis with eating, and had been admitted to the Children's Hospital October 8, 1940, at the age of 2½ months, because of fever, severe cough and dyspnea.

These records at the Children's Hospital were reviewed, and the clinicians had, indeed, suspected the presence of a tracheoesophageal fistula. X-rays taken after injection of lipiodol into the trachea were read as showing lipiodol in the esophagus and stomach, and a small amount in the trachea and left main bronchus. The roentgenologist believed there was no definite evidence of tracheoesophageal fistula. The clinicians, however, continued to believe she had this defect. During the next several years, she had frequent episodes of aspiration pneumonitis, and coughing while eating was experienced intermittently. At times, she would go for long periods without coughing with meals.

As she grew older, she had a chronic cough pro-

ductive of purulent sputum, and had two or three episodes of pneumonitis yearly. During the past six years, she had experienced severe coughing while eating only on a very few occasions. Apparently no one had ever suggested surgical treatment for repair of the tracheoesophageal fistula. On April 28, bilateral bronchograms were made which showed a normal left bronchial tree, and severe bronchiectasis and atelectasis of all lobes of the right lung (fig. 2). On May 1, through a right posterolateral thoracotomy incision, a right pneumonectomy was done. The lung was adherent to the chest wall, diaphragm and mediastinum by very dense adhesions. The lower and middle lobes were completely atelectatic and rubbery in consistency, and there were large, rubbery lymph nodes at the hilum of the lung and in the mediastinum. It was noted that the positive pressure anesthesia caused ballooning of the esophagus. At the level of the third rib posteriorly, a fistula 1.5 cm. in diameter between the anterior surface of the esophagus and the posterior aspect of the trachea was found and divided. The openings in the two structures were closed with interrupted

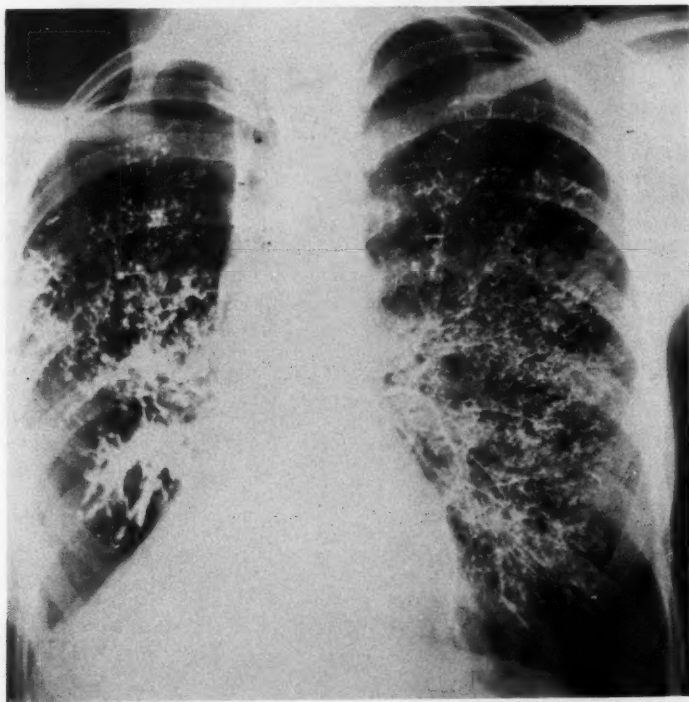


FIG. 2 (case 3). Bilateral bronchograms showing severe bronchiectasis of right lung. The left bronchogram is normal.

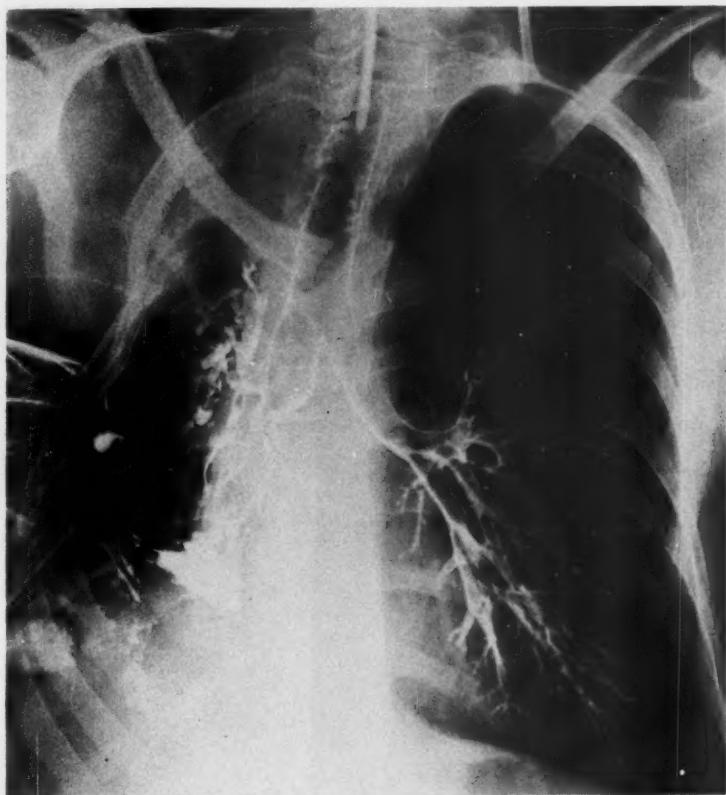


FIG. 3 (case 4). Bilateral bronchograms showing normal left lung. The right lung is bronchiectatic and contracted. The opaque medium is present on the wound dressing due to the multiple broncho-pleural fistulas. Deformity of rib cage on right is due to multiple previous operations.

fine silk sutures and covered with tissues from the surrounding area. Her postoperative course was uneventful and three months after surgery, her cough had completely disappeared.

*Case 4.* J. P. W., a 30-year-old man, was admitted to National Jewish Hospital December 19, 1956 with the history of repeated episodes of pneumonia involving the right lung since the age of 5 years. He had had a draining wound in the right chest since the second of four operations performed between the ages of 5 and 9 years, to drain abscesses of the right lung. Food particles had been noted at times in the large amounts of mucopurulent drainage. In spite of this handicap, he had worked regularly as an automobile mechanic. On examination, he was thin and appeared chronically ill. There was a defect in the right anterolateral chest wall beneath the axilla which measured 17 cm. in diameter. The ribs in this area had been resected. The floor of the defect con-

tained numerous small bronchial fistulas. Bronchoscopic examination revealed a normal left bronchial tree, but there was granulation tissue and narrowing of the lumen at the right intermediate bronchus. Bronchograms (fig. 3) revealed marked contraction and severe bronchiectasis of all lobes of the right lung. On esophagoscopic examination, inflammation of the mucosa 34 cm. from the upper incisor teeth was noted. X-ray study of the esophagus failed to reveal a fistula, but barium particles were noted in the wound drainage following this examination.

At operation January 11, 1957, there was complete obliteration of the pleural space by dense adhesions. A pleuropneumonectomy was performed. There was a smooth, elastic fistula connecting the esophagus to the right intermediate bronchus, which measured 7 mm. in length and 5 mm. in diameter. The fistulous tract was divided and the opening in the esophagus closed



FIG. 4 (case 4). Postoperative x-ray following right pleural pneumonectomy, closure of esophageal fistula and modified Bjork type thoracoplasty.

with two rows of interrupted silk sutures. The size of the remaining pleural space was reduced by a Bjork-type thoracoplasty.<sup>1</sup> The chest wall defect was closed after débridement and a rubber tube brought out from the pleural space through a stab wound and connected to a water seal drainage bottle. Following removal of this tube, there was a small empyema space which closed progressively. He was dismissed from the hospital March 30. His wounds were well healed and he had no difficulty on swallowing (fig. 4).

#### COMMENT

As pointed out by Haight,<sup>3</sup> the term tracheoesophageal fistula is often loosely used to include an esophageal atresia which is not accompanied by a connection with the trachea. Although a tracheoesophageal fistula is usually present with esophageal atresia, the atresia may occur alone.

Conversely, there may be a fistulous tract between the trachea or bronchus and the otherwise normal esophagus (fig. 5). Haight<sup>3</sup> suggested the following three categories: (1) esophageal atresia with tracheoesophageal fistula, (2) esophageal atresia without tracheoesophageal fistula, and (3) tracheoesophageal fistula without esophageal atresia. The term *esophageal atresia* then, includes atresia with or without tracheoesophageal fistula, and the term *tracheoesophageal fistula* designates those cases where there is a fistula between the trachea and an otherwise normal esophagus.

*Incidence.* Esophageal atresia occurs about once in every 3000 births, and tracheoesophageal fistula occurs in about 3 per cent of the combined series. Haight<sup>3</sup> has seen 7 cases of tracheoesophageal fistula in over 200 cases of esophageal atresia. DeBoer and Potts,<sup>2</sup> in an experience with

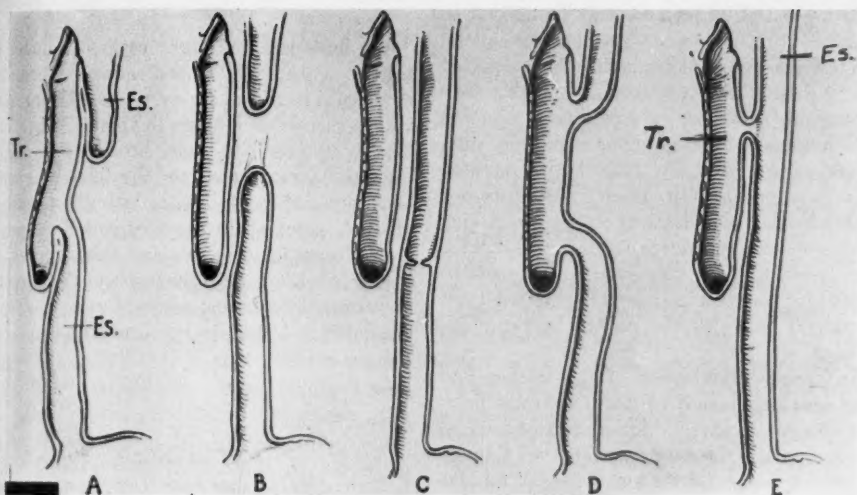


FIG. 5. Various types of congenital esophageal atresia

117 cases of esophageal atresia, treated only 1 patient with tracheoesophageal fistula. Mullard,<sup>5</sup> in 1945, reviewed the literature on this subject and was able to collect about 30 cases of congenital tracheoesophageal fistula, and only 3 of these had been treated surgically. He added 2 cases of his own which he had treated surgically.

**Embryology.** The embryology of atresia of the esophagus and tracheoesophageal fistula is not fully understood. These anomalies originate in the embryo before the 8-mm. stage. Pressure by aberrant vessels or persistent aortic arches or great veins, or by the relatively large foetal heart and pericardium have been considered as causative factors. Gruenwald<sup>4</sup> theorized that rapid elongation of the trachea before the esophagus and trachea separated from each other could result in attenuation and fragmentation of the esophagus and could also result in atresia of the esophagus with or without esophageal fistula, or in tracheoesophageal fistula without atresia of the esophagus, depending on how much separation of the two structures had occurred before the rapid and unequal increase in length of the trachea occurred.

**Signs and symptoms.** The symptoms of tracheoesophageal fistula are referable to the respiratory tract and are dependent upon the site, size, and direction of the esophago-respiratory communication, and upon the consistency of the ingesta. When the fistulous opening is large, and particu-

larly when the lower end of the abnormal communication is in the trachea or bronchus, symptoms will occur with the first feedings in the infant, and will be severe. Characteristically, these symptoms consist of coughing and choking associated with feedings, and repeated episodes of aspiration pneumonitis. Severe gaseous abdominal distention has been frequent in the reported cases, and typically, may appear suddenly with crying or straining as the result of the increased intratracheal pressure forcing air through the fistula and esophagus into the stomach. If the fistula is small, or its esophageal opening protected by a mucosal fold, or if the obliquity of the fistulous tract permits it to close during swallowing, or if the lower end of the fistula is in the esophagus, symptoms may not be severe, or may not occur until an older age, or may occur only occasionally.

When the lower end of the fistula is in the esophagus, there may be no difficulty with swallowing, but symptoms may occur if the regurgitated material passes through the fistula. Such episodes are more apt to occur when the baby lies in the prone position. It is noteworthy that about half the reported cases have been in older children or adults.

**Diagnosis.** Unless a fistula between the esophagus and respiratory tract is suspected, it is unlikely to be found accidentally, and even if sus-



pected, proof of its presence may be difficult to establish.

A tracheoesophageal fistula should be suspected in any patient with a history of coughing associated with eating, or in any patient who has sudden episodes of coughing or respiratory difficulties, as well as in any patient with repeated episodes of pneumonitis. Infants with disturbed neuromuscular coordination of the swallowing mechanism may experience coughing and choking with feedings. X-ray examination of the esophagus using free-flowing contrast material must be carried out with the patient in the prone position.

Endoscopic examination of the trachea and esophagus may permit visualization of the fistulous opening. Methylene blue can be injected into the trachea and the esophagus observed through an esophagoscope for the appearance of the dye in the esophagus. Despite the repeated use of these various diagnostic procedures, one may not be able to demonstrate the abnormal tracheoesophageal communication.

We believe that if there is strong suspicion of a fistula, and its presence cannot be demonstrated by these procedures, exploratory thoracotomy is indicated without further delay. Death or irreversible lung damage may occur while waiting to establish a certain diagnosis before resorting to surgical treatment.

#### SUMMARY

We have reported three cases of congenital tracheoesophageal fistula and one case of bronchoesophageal fistula which were treated surgically, with a successful outcome in three of the cases. The symptoms and signs produced by these anomalies are presented, and the difficulties sometimes encountered in demonstrating the presence of such fistulas are emphasized. Exploratory thoracotomy for diagnosis and treatment is advisable when one strongly suspects the presence of a tracheoesophageal fistula, but is unable to demonstrate it by radiographic or endoscopic procedures.

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#### REFERENCES

1. BJÖRK, V. O.: Pneumonectomy for pulmonary tuberculosis. *J. Thoracic Surg.*, 32: 528, 1956.
2. DEBOER, A., AND POTTS, W. J.: Congenital atresia of esophagus with tracheoesophageal fistula. *Surg. Gynec. & Obst.*, 104: 475, 1957.
3. HAIGHT, C.: Some observations on esophageal atresias and tracheoesophageal fistulas of congenital origin. *J. Thoracic Surg.*, 34: 141, 1957.
4. GRUENWALD, P.: Case of atresia of esophagus combined with tracheo-esophageal fistula in 9-mm. human embryo, and its embryological explanation. *Anat. Rec.*, 78: 293, 1940.
5. MULLARD, K. S.: Congenital tracheoesophageal fistula without atresia of the esophagus. *J. Thoracic Surg.*, 28: 39, 1954.

# HYPNOSIS IN GENERAL SURGERY\*

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Hypnosis has played a part in human life since man adopted the communal type of society. Egyptian writings of 3000 years ago describe hypnotic procedures much as they are performed today. Although his explanations were not correct, Franz Anton Mesmer, who lived from 1733 to 1815, begins the modern history of hypnosis.<sup>6, 13</sup> It was he who felt that magnetic control of the body fluids by the physician gifted with this power could cure illness and disease, the origins of which were felt by him to be an improper flow of these body fluids. It was while carrying out therapy with "magnetism" that he noted the occurrence of a trancelike state. Mesmer felt that "magnetism" and the trance state were related.

A Scotch physician, James Braid,<sup>1</sup> practicing in England about 1800, found that he could induce a trance-like state by suggestion and the gaze-fixation technique. He coined the word hypnosis (from the Greek *hypnos*, meaning sleep), to describe this new science and the trance condition produced. For many years Braid performed operations under hypnotic anesthesia.

According to Moll,<sup>10</sup> surgical operations were performed on "magnetized" subjects by Recamier in 1821. In 1829 Cloquet reported to the French Academy of Medicine on his use of such anesthesia. In 1843, John Elliotson reported on his experiments, done much earlier (1838). In the United States, about the same time, Dr. Albert Wheeler performed a nasal polypectomy under hypnosis, Doane removed a tumor of the neck as did Ackley, and Dugas did a breast amputation.<sup>5</sup>

James Esdaile, an Englishman practicing in India,<sup>5</sup> performed many surgical operations from 1840 to 1845 with "mesmerism" or "magnetism" as the anesthesia.

In 1864, A. A. Liebeault, after reading Braid's book, emphasized suggestion as the basis of everything in hypnosis (just as did Braid). From this time on, hypnosis was firmly established in

Europe. The story after this is a repetition of waves of enthusiasm followed by periods of ridicule and rejection.

The development of modern chemical anesthesia and the use of hypnotism by the stage performer, the lay quack, the "faith-healers," and the nonprofessional have been the chief forces deterring the medical uses and the medical acceptance of hypnotism as another tool in the physician's armamentarium.

## DEFINITION

Weitzenhoffer<sup>14</sup> gives two definitions of hypnosis, one descriptive, the other operational. The descriptive definition is: "Hypnosis is a condition or state of selective hypersuggestibility brought about in an individual (subject) through the use of certain specific psychologic or physical manipulations of the individual by another person (hypnotist)." The operational definition is: "Hypnosis is a condition of selective hypersuggestibility specifically brought about in an individual by the use of the combination and sequence of visual fixation upon a small target-object and suggestions of relaxation, of various symptoms of sleep (particularly heaviness of the eyelids), of closure of the eyes, and finally of sleep." Suggestibility is the capacity to respond to an idea. Hypnosis has been explained as (1) a form of sleep, (2) a conditioned reflex, (3) a regression to infancy, (4) behavior as the subject believes a hypnotized individual should behave, or (5) as a dissociation of the conscious and subconscious.

## SOME BASIC CONCEPTS

In one text on hypnosis,<sup>12</sup> the statement is made that "hypnosis has been used with surgical patients (a) for the production of anesthesia, (b) for the differential diagnosis of psychiatric from surgical conditions, and (c) for the investigation and treatment of emotional factors which seem to create surgical problems, interfere with smooth preoperative preparation of patients, or complicate otherwise potentially uneventful postoperative recoveries."

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It is my feeling that the latter two categories should be reserved for the psychiatrists. To classify these two groups of patients within the realm of treatment of the general surgeon automatically gives the psychiatrist the ammunition with which to attack the surgeon in the latter's use of hypnosis. I feel that hypnosis has a definite nonpsychiatric role in the general surgeon's armamentarium. Hypnosis has proved of value in the preoperative, operative, and postoperative phases of treatment of my patients.

One of the most important points in the use of hypnosis in surgery is self control on the part of the surgeon. Hypnosis should be looked upon as an aid but not a cure-all. It is not a substitute for general anesthesia, analgesics, or narcotics. If hypnosis is not helpful in a specific patient, leave it and try its use again in some other patient. Don't force hypnosis to fit the patient. Don't become discouraged if all patients do not react similarly.

I do not discuss hypnosis, as such, with the patient unless the patient brings up the subject. Instead, I lead the patient into a discussion of relaxation. From that point, we progress to my teaching the patient how to relax. I have found that, with many patients, discussing hypnosis erects a barrier which must be removed before any progress is made. However, everyone wants to learn how to relax. Since suggestibility is the basis of hypnosis, to tell the patient about the lack of danger, the lack of ill effects, etc., automatically suggests to him a basis for the necessity of such explanations.

For the practicing surgeon, time is usually very important. Therefore if hypnosis is going to be a long, drawn-out affair, the average busy surgeon will probably shy away from its use. Most patients can be placed into at least a hypnoidal state or a light trance state within 10 min., even on the first interview.

Patient selection, techniques and methods of production of hypnosis are well covered in the literature.<sup>7, 8, 11, 12, 14</sup>

Males are as suggestible and susceptible to hypnosis as are females. Children are said to be most susceptible between the ages of 5 and 16 years, with the peak at 8 years.<sup>8</sup> I have used hypnosis in some children of 3 and 4 years of age. Most adolescents and adults (85 to 90%)<sup>8, 9</sup> can be hypnotized. Although adults are less suggest-

ible as they grow older, many elderly people can be hypnotized.

The state of hypnosis is divided into four levels beyond the group labeled as uninfluenced. These are: hypnoidal, light trance, medium trance, and deep or somnambulistic trance.<sup>8</sup> Approximately five to ten per cent of individuals are not susceptible to hypnosis. Ten per cent of persons may be taken into a hypnoidal state, another 25 per cent into the light trance, 35 per cent the medium trance, and 20 to 25 per cent into the deep or somnambulistic trance.<sup>8, 9</sup>

The hypnoidal state may be recognized by the following features:<sup>4</sup> (1) physical relaxation, (2) fluttering of the eyelids, (3) closing of the eyes, and (4) heaviness of the limbs.

The light trance state has the following objective characteristics:<sup>4, 8</sup> (1) catalepsy of the eyes, (2) catalepsies of the limbs, (3) rigid catalepsy, (4) respirations become deeper and more slow, (5) pulse slows, (6) lassitude, (7) twitching of mouth, lips, or jaw, (8) involuntary start or eye twitching on awakening, and (9) glove anesthesia (some feel that this occurs only in the medium trance).

The medium trance state can be identified by the following objective features:<sup>4, 8</sup> (1) partial amnesia, (2) glove anesthesia, (3) posthypnotic anesthesia, (4) complete catalepsy of limbs, (5) following the simple posthypnotic suggestions, (6) kinesthetic delusions (tactile, gustatory, and olfactory), (7) hyperacuity of sensations, and (8) complete amnesia (some feel that this occurs only in the somnambulistic state).

The patient in a deep trance or somnambulistic state may exhibit the following:<sup>4, 8</sup> (1) ability to open eyes without affecting trance, (2) complete amnesia, (3) bizarre posthypnotic suggestions, (4) complete somnambulism, (5) positive visual and auditory hallucinations, (6) posthypnotic visual and auditory hallucinations, (7) negative visual and auditory hallucinations, (8) hyperesthesias, (9) loss of eye coordination, (10) hyperamnesia, (11) age regression, and (12) stimulation of dreams.

For the general surgeon the use of hypnosis will be confined largely to the hypnoidal, light, or medium trance states. Occasionally for deep anesthesia, it will be necessary to carry the patient into a deeper plane. I should like to point out that the performance of an operation under hypnoanesthesia does not always have to take

place in the medium or deep trance states. Anesthesia has been produced in some of my patients in the light trance. This will be determined by the individual patient. Also, these various trance states may mingle somewhat at their borders in their manifestations. They are not completely enclosed compartments.

#### PRECAUTIONS

It is stated that the prepsychotic individual may become psychotic following hypnotherapy. Therefore, a prehypnotic psychiatric evaluation would be of value in predicting possible after-effects of the use of hypnosis. However, in the use of hypnosis in surgery, as presented here, there is little likelihood of the occurrence of this event. This would be most likely in the situation of the removal of symptoms (or the taking away from a patient of his psychologic crutch). It might be added that this situation can occur under any form of psychotherapy and is, therefore, not peculiar to the use of hypnosis.

Always have a third person present during the procedure of hypnosis. However, this person may be separated from the patient by a flimsy curtain, screen, or two-way mirror, in order to let the patient feel he has privacy.

An undisturbed atmosphere is not absolutely essential for hypnosis, but is necessary for consistent results. It has been possible to hypnotize patients in busy and noisy hospital accident rooms and operating suite hallways.

Alcohol and sedatives may aid the induction of hypnosis if they have not been taken in excessive amounts.

Always take the time necessary to put your patient at ease before beginning hypnosis.

It is most important to think of yourself as a teacher and your patient as a pupil. Do not promise something on which you will be unable to follow through or which will be unattainable for the patient. This applies to the prehypnotic conversation as well as to the suggestions which might be given under hypnosis.

Do not persist in trying to use hypnosis if the patient is antagonistic or objects.

Do not use hypnosis as a form of entertainment for yourself or for others.

Do not put a patient through multiple tests in order to prove to yourself that he is hypnotized. Learn to recognize the state without these tests. The main features of the state of hypnosis which

TABLE 1

#### General surgical clinical applications

- I. Preoperative apprehension and anxiety (cases 1 through 9)
- II. Distressing surgical treatments—intubations, intravenous fluids, endoscopies, etc. (cases 10 through 12)
- III. Examination of acute abdomen
- IV. Examination of ticklish abdomen (case 13)
- V. Emergency out-patient surgery (cases 14 and 15)
- VI. Burns—early and late
- VII. Hypnoanesthesia (cases 16 through 28)
  - A. Sensitive to local anesthetic
  - B. Local anesthesia contraindicated (infection, obliteration of details, etc.)
  - C. Position maintenance
  - D. Major surgery in:
    1. Cardiac
    2. Asthmatic
    3. Respiratory diseases
    4. Neurologic disorders
    5. Fear of death
- VIII. Relief of painful or distressing postoperative situations (cases 29 through 35)
  - A. Relief of pain
  - B. Ambulation
  - C. Cough stimulation
  - D. Rectal operations
  - E. Urinary retention
  - F. Dressings
  - G. Patient induced fears—stitches, tape, etc.

enable one to recognize its presence are: (1) smoothing of the facial features, (2) quivering of the facial muscles and jaw, (3) sighing respirations becoming deeper and more slow, and (4) slowness and deliberateness of movements, (however, on occasion, the movements will be rapid and sudden).

Occasionally, when hypnosis is over, a patient will say: "Doctor, I wasn't asleep," or "I wasn't under—I heard everything," or "I don't like that, let's not do it again." Don't be anxious to show up this patient or to disprove his statements. Do not feel that he is attacking you. Leave him his crutch. Simply reply something like: "but you certainly relaxed beautifully"—and let it go at that.

Never use hypnosis as a means of self-ego inflation. Because of the mystery and drama attached to hypnosis, the hypnotist may be carried away by the magic power of his own words. If

TABLE 2

*Clinical examples of the use of hypnosis in general surgery (see outline)*

Number	Case	Age	Color	Sex	Use
1	R. N.	5	N	M	Repair of laceration—used in preparation for injection of local
2	H. P.	39	W	F	Allay extreme preoperative apprehension
3	D. S.	7	W	F	Allay apprehension preoperatively
4	A. B.	44	W	F	Allay apprehension of local anesthesia
5	B. C.	3	W	M	Repair of laceration, aided by local infiltration
6	R. F.	26	W	F	Allay preoperative apprehension
7	K. H.	19	W	F	Preoperative apprehension in a pregnant female with a breast tumor
8	M. L.	41	W	F	Apprehension allayed and multiple papillomas excised with hypnoanesthesia
9	B. M.	43	W	F	Extreme preoperative apprehension; posthypnotic suggestion regarding stitch removal
10	D. P.	32	W	F	Sigmoidoscopy done where formerly it could not be done
11	P. J.	9	W	F	Removal of drains from finger (bone felon)
12	C. S.	22	W	F	Removal of drains from finger (bone felon)
13	M. E.	11	W	F	Abdominal pain and markedly ticklish
14	A. L.	5	W	F	Repair of forehead laceration
15	B. S.	11	W	F	Screaming, frightened; repair of laceration
16	D. P.	32	W	F	Removal of foreign body from sole of foot
17	C. R.	6	W	F	Excision of toe-nail
18	G. R.	35	W	F	I and D of paronychia, excision of fingernail
19	C. S.	27	W	F	Excision of tumor of finger
20	M. B.	5	W	F	Excision of toe-nail
21	P. D.	49	W	M	I and D of scrotal abscess
22	S. H.	19	W	M	Debridement of foot wound
23	L. H.	33	W	M	I and D of elbow abscess
24	C. S.	38	W	M	Debridement of leg
25	E. Y.	7	W	M	I and D of abscess
26	H. S.	28	W	F	Excision of tumor of tongue—hypnoanesthesia with position maintenance
27	V. B.	24	W	M	Proctosigmoidoscopy
28	E. D.	71	W	M	Umbilical hernia repair—10 cc. of local used
29	A. S.	40	W	F	Postoperative cholecystectomy with atelectasis and fear of cough
30	F. P.	36	W	M	Postoperative hemorrhoidectomy sphincter spasm; relief of pain and voiding difficulty
31	E. E.	38	W	F	Rectal dilatation; posthemorrhoidectomy and removal of itching
32	H. G.	34	W	F	Rectal itching, posthemorrhoidectomy, removed
33	R. H.	11	W	M	Cast removal—fear of injury by cast cutter
34	E. W.	5	W	M	Removal of stitches
35	A. B.	44	W	F	Removal of stitches

one remembers that this is a therapeutic tool, to be used only to help the patient, this is unlikely to happen.

There will be some people who cannot be hypnotized. This might be on the basis of personality clashes, fear, lack of cooperation, or lack of intelligence. There will be patients with whom

you will be unsuccessful in your attempts at hypnosis but with whom another physician will succeed. These failures must be expected and accepted. They must not be allowed to deter the physician in his future use of hypnosis. Attempts on members of one's own family group are notoriously unsuccessful and should be avoided.



If hypnoanesthesia is produced, remember to remove this state before bringing the patient out of hypnosis. This holds true for any abnormal states or positions produced under hypnosis.

#### CLINICAL APPLICATIONS

A patient's preoperative apprehension and anxiety can be very distressing, both to the patient and to the surgeon. Although simple conversation and explanation by the surgeon can do much to alleviate these sensations while he is present and, although sedatives and tranquilizers can help, hypnosis can play a big role in averting or converting the patient's feelings. Preoperative hypnosis can give many patients a comfortable preoperative night's rest. Hypnosis can change the frightened, crying patient, lying in the anesthetic room or hallway just prior to surgery, into a calm, relaxed individual. Since apprehension and fear may give a rough anesthetic induction, these symptoms should be relieved or changed if possible.

Many times surgical patients may undergo very distressing treatments, such as gastrointestinal intubations, intravenous alimentation cystoscopy, gastroscopy, sigmoidoscopy, bronchoscopy, etc. Occasionally the disease process plus the discomfort of the therapy are too much for the patient. Hypnosis can relieve the discomfort and enable the patient to meet his difficulties in a better frame of mind. By adding posthypnotic suggestions the surgeon can prolong the action of his suggestions.

Sometimes the physical examination of an acute abdominal case can be difficult, especially with respect to the pelvic and rectal portions. This seems to be particularly true in women and children. The patient is in pain, apprehensive, and cannot cooperate completely. By the utilization of the hypnoidal or light trance states, one can perform the examination without difficulty. I do not think that any posthypnotic suggestions should be given in this type of situation.

Ticklishness, on abdominal palpation, presents a similar problem which hypnosis can overcome.

The patient with an injury or disease requiring emergency out-patient surgery may pose quite a problem, especially if it is a child. The patient may be a screaming, apprehensive individual. The injuries require surgery but a general anesthetic may be contraindicated because of recent food intake, upper respiratory tract infection,

delay before getting into the operating room, etc. It is possible to hypnotize this type of patient and carry out the entire procedure under local infiltration anesthesia with ease and quiet. It is not necessary to substitute hypnosis for local infiltration anesthesia, but simply to control and calm the patient until the anesthetic can be injected.

Hypnosis has been used in burn cases.<sup>2</sup> It serves beautifully to allay apprehension, and it has been used to stimulate appetite. In addition, it can be used during painful repeated dressings and thus avoid multiple general anesthetics. When the phase of mobilization of parts and muscle re-education begins, hypnosis can play an important role in overcoming fear and pain. In addition, by means of the phenomenon of age regression, forgotten muscle movements can be brought forth.

As stated earlier, hypnosis has been used as an anesthetic agent for a long time. It is important at this point to clarify the meaning of hypnoanesthesia. This state is not true anesthesia (loss of sensory preception), but is analgesia (loss of pain perception). Hypnosis should not take the place of the techniques and agents of modern anesthesiology. However, there are certain types of cases for which hypnosis serves the best purpose. Hypnoanesthesia can be produced in one out of every four individuals on the first trial. With further training of the patient, this percentage of success can be increased. It has been my experience that anesthesia can be produced in many patients in the light trance state.

One type of case in which hypnoanesthesia would be indicated is the patient who is known to be sensitive to local anesthetic agents and who requires surgery. Rather than resort to a general anesthetic with its possible complications, the surgeon can utilize hypnosis for the procedure. Regardless of the area of the body being operated upon, this method is effective to the same degree. Lesions of the sensitive palmar pads of the digits, of the sole of the foot, of the rectum and anus, of the tongue, of the breast, and of the scrotum have all been managed in this way.

There are conditions in which local infiltration is contraindicated. These are patients with inflammation, infection, contaminated acute injuries, foreign bodies, abscesses, carbuncles, etc. In these it might be desirable to avoid a general anesthetic. These procedures can be carried out easily under hypnoanesthesia.

Position maintenance during many surgical procedures and examinations can be more uncomfortable or painful to the patient than the procedure itself. This may be true in any of the endoscopies mentioned previously. Hypnosis or relaxation helps the surgeon and the patient. Operations within the mouth, or the buccal mucosa, pharynx, or tongue, which require painful constant position on the part of the patient can be made easy with the aid of hypnosis. If desired, it is possible to carry out the entire operation under suggestion and relaxation without any anesthetic.

At this point, it is important to re-emphasize the fact that hypnoanesthesia (or hypnoanalgesia) is not limited to what would technically be classified as minor surgery. All sorts of major operative procedures have been reported (including mastectomy, amputations, fracture reductions, hysterectomy, cesarian section, tumor of pharynx, thyroidectomy, and hernia repair).<sup>5, 7, 8</sup> Patients with the following types of disorders would be candidates for hypnoanesthesia: (1) cardiac disease, (2) asthma, (3) respiratory tract disease (bronchitis, bronchiectasis, and tuberculosis), (4) neurologic disorders (epilepsy, multiple sclerosis, syringomyelia, poliomyelitis, and high spinal cord lesions), and (5) fear of death while under a general anesthesia.

There are many painful or distressing post-operative situations which also can be aided or prevented by the use of hypnosis. These include: (1) relief of pain which is increased by apprehension, (2) delay in ambulation because of fear of pain or fear of disability, (3) stimulation of cough postoperatively, especially in abdominal and thoracic surgery, (4) elimination of fear and pain in rectal surgery, (5) elimination of urinary retention secondary to spasm and fear of exerting intra-abdominal pressure, (6) multiple painful dressings, as in burn cases, infected wounds, and removal of packs or drains, and (7) elimination of self-made fears, such as those of removal of stitches and of removal of adhesive tape.

In a presentation of this sort, it would be improper not to list the claimed disadvantages of hypnosis.<sup>3</sup> One is that some people cannot be hypnotized. This is a small group. However, if we were to eliminate all therapeutic agents which are not 100 per cent effective we would be without almost all of our drugs. Sometimes just the trial

at relaxation can make the patient less apprehensive even if hypnosis is not achieved.

Another disadvantage is that not all susceptible individuals can be gotten deep enough for hypnoanesthesia. However, even the hypnoidal or light trance states can help somewhat.

The objection has been raised to the amount of time necessary to achieve hypnosis. I do not think that this is a valid objection. The psychiatrist or hypnotherapist requires a prolonged induction and deep trance. However, the surgeon can do most of his work in the hypnoidal or light trance state. This will actually take no more than an additional 10 to 15 min. Even if one sets this time limit for the use of hypnosis on the first occasion that the patient is seen, the percentage of success will approximate 85 per cent.

The necessity of training and the development of skill in hypnosis should be regarded as a prerequisite rather than a disadvantage. It is no more disadvantageous than an internship or residency training.

The objection that has been raised by the psychiatrists has been discussed earlier. I feel that as long as surgeons do not try to encroach upon hypnotherapy, and stick to surgery, the psychiatric risk is practically absent.

#### SUMMARY

1. This short presentation attempts to point out the possibilities for the use of hypnosis in general surgery.
2. A brief historic review of its use in surgery is given.
3. Some important basic points about the use of hypnosis are covered, including the recognition of the various states.
4. Precautions to be observed are reviewed.
5. The various surgical clinical applications are discussed.

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#### REFERENCES

1. BRAID, J.: *Neurypnology; or the Rationale of nervous sleep, considered in relation with animal magnetism*. J. Churchill, London, 1843. Quoted in 8.
2. CRASLNECK, H. B., STIRMAN, J. A., WILSON, B. J., MCCRANIE, E. J., AND FOGELMAN, M. J.: Use of hypnosis in the management of patients with burns. *J. A. M. A.*, 158: 103, 1955.

3. CRASILNECK, H. B., MCCRANIE, E. J., AND JENKINS, M. T.: Special indications for hypnosis as a method of anesthesia. *J. A. M. A.*, 162: 1606, 1956.
4. DAVIS, L. W., AND HUSBAND, R. W.: Study of hypnotic susceptibility in relation to personality traits. *J. Abnorm. & Social Psychol.*, 26: 175, 1931.
5. ESDAILE, J.: *Hypnosis in Medicine and Surgery (Mesmerism in India)*. New York, The Julian Press, 1957 (Reissue).
6. GOLDSMITH, M. L.: *Franz Anton Mesmer; a History of Mesmerism*. New York, Doubleday Doran, 1934. Quoted in 8.
7. HERON, W. T.: *Clinical Applications of Suggestion and Hypnosis*. Springfield, Illinois, Charles C Thomas, 1950.
8. LECRON, L. M., AND BORDEAUX, J.: *Hypnotism Today*. New York, Grune & Stratton, Inc., 1947.
9. MASON, A. A.: Hypnosis for the relief of pain. *Proc. Roy. Soc. Med.*, 49: 481, 1956.
10. MOLL, A.: *Hypnotism*. New York, Charles Scribner's Sons, 1901. Quoted in 8.
11. RHODES, R. H.: *Hypnosis*. New York, The Citadel Press, 1950.
12. SCHNECK, J. M.: *Hypnosis in Modern Medicine*, Chapter 3. Springfield, Illinois, Charles C Thomas, 1953.
13. SACKETT, W. W., JR.: History of medical hypnosis. *South. M. J.*, 48: 306, 1955.
14. WEITZENHOFFER, A. M.: *General Techniques of Hypnotism*. New York, Grune & Stratton, Inc., 1957.

## INTRAPERITONEAL AND EXTRAPERITONEAL NEOMYCIN AS A TOPICAL AND IRRIGATING AGENT\*

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The value of any antibiotic as a topical cleansing agent lies in its ability to sterilize an already contaminated area, to prevent direct contamination of an area, and to prevent the development of infection in so-called "clean" wounds. Each clinically accepted antibiotic has been tested as a topical and irrigating agent.

Some of the difficulties which have followed the local or irrigating use of the antibiotics have been toxicity from systemic absorption, sensitization, and the development of organism resistance.

The purpose of this report is to give the results of the use of neomycin sulfate solution as a topical and irrigating agent, and to point out that its use in the proposed dosage and concentration has not proved to be toxic.

### NEOMYCIN SULFATE

Neomycin sulfate is a water soluble salt of the antibiotic discovered by Waksman and Lechevalier,<sup>16</sup> and obtained from cultures of *Streptomyces fradiae*. It is unusually stable in the presence of body secretions, digestive enzymes, necrotic tissue, and products of bacterial growth.<sup>1</sup>

The antibacterial effectiveness of neomycin sulfate extends over an extremely broad range of organisms.<sup>1, 15</sup> This drug is highly active against Gram-negative and Gram-positive bacteria (table 1). Neomycin is both bacteriostatic and bactericidal.

Neomycin may be administered orally for sterilization of the intestinal tract.<sup>1, 9-11</sup> Only 3 per cent of the drug is absorbed, and this is rapidly excreted in the urine. If neomycin is given parenterally there may be toxic manifestations. One must always be aware of the possibility of systemic absorption from the topical application of any drug. This is particularly true of the peritoneal cavity. The toxic manifestations from systemic administration are reported as nephrotoxic, neurotoxic, and respiratory arrest.<sup>11, 14</sup> The toxic effects on the eighth nerve are principally audi-

tory and are irreversible. Nephrotoxic manifestations, including mild albuminuria, presence of granular casts, and depression of urinary output with an elevation of blood urea nitrogen are usually reversible, disappearing after the discontinuation of the administration of the drug.

When a total daily parenteral dose of neomycin sulfate exceeds 15 mg. per kg. of body weight (more than 1 gm. per day) and it is continued for more than 10 days, signs of toxicity referable to the renal, neural, and auditory function may develop.<sup>1</sup>

Poth,<sup>9-11</sup> who has written extensively on intestinal antisepsis, recommended, in 1957, the use of 200 cc. of a 0.5 per cent solution immediately after evacuating the peritoneal cavity and abdominal wall layers. (Poth does not explain the changes in his recommendations in 1952, 1954, and 1957. In 1952 Poth<sup>9</sup> stated that 1 or 2 gm. of a 1 per cent neomycin solution could be placed in the human peritoneal cavity. In 1954,<sup>10</sup> he stated that 2 to 3 gm. of a 1 per cent solution could be placed in the grossly contaminated peritoneal cavity and another 1 gm. at the end of the procedure.)

The A. M. A. Council on Pharmacy and Chemistry reported<sup>1</sup> that the toxic serum concentration was 0.2 mg. per cc. and that nephrotoxic effects were demonstrable at this level. It also reported a suggested topical dosage of 5 mg. per cc. There was no specific mention of intraperitoneal usage.

Schatten<sup>13</sup> did not find any evidence of toxicity in his use of neomycin intraperitoneally in 18 cases of peritonitis over a period of 72 hr. He used 1 gm. of the drug at the time of surgery, and administered 500 mg. every 6 hr. through an indwelling polyethylene catheter. This was a 0.2 per cent solution. The serum concentration 1 hr. after the intraperitoneal administration of 500 mg. of neomycin sulfate (0.2 per cent solution), given over a period of 1 hr., was 0.008 mg. per cc. Schatten found that the intraperitoneal method of parenteral administration results in high peak levels of the antibiotic in the peri-

\* From the Departments of Surgery, Sinai Hospital, and The Johns Hopkins Hospital and School of Medicine, Baltimore, Maryland.

TABLE 1

Antimicrobial spectrum of neomycin<sup>3, 15</sup>

<i>Aerobacter aerogenes</i>	<i>Mycobacterium tuber-</i>
<i>Escherichia coli</i>	<i>culosis</i>
<i>Proteus vulgaris</i>	<i>Bacillus anthracis</i>
<i>Pseudomonas aerugi-</i>	<i>Staphylococcus albus</i>
<i>nosa</i>	<i>Staphylococcus</i>
<i>Klebsiella pneumoniae</i>	<i>aureus</i>
<i>Hemophilus influenzae</i>	<i>Corynebacterium diph-</i>
<i>Neisseria catarrhalis</i>	<i>theriae</i>
<i>Salmonella typhosa</i>	<i>Streptococcus viridans</i>
<i>Salmonella paratyphi</i>	<i>Streptococcus agalac-</i>
<i>Salmonella schottmuel-</i>	<i>tiae</i>
<i>leri</i>	<i>Streptococcus pyogenes</i>
<i>Shigella dysenteriae</i>	<i>Streptococcus faecalis</i>
	<i>Bacillus subtilis</i>

toneal cavity and slightly lower serum levels than are usually obtained by intravenous administration of the antibiotic.

Waksman and his associates<sup>15</sup> found that the LD<sub>50</sub> for intraperitoneal neomycin in mice was 125 mg. per kg. of body weight. Spencer and co-workers<sup>14</sup> found that the LD<sub>50</sub> was 116 mg. per kg. body weight. Kadison and his associates,<sup>1</sup> however, found that mice tolerated intraperitoneal injection of neomycin solution in the concentration of 132 mg. per kg. of body weight.

Pittinger and Long<sup>8</sup> report that in rabbits anesthetized with ether, neuromuscular blockade could be produced by intravenous doses of 2 mg. per kg. of body weight. They noted that it took 20 to 40 mg. per kg. of body weight to produce the same effect in unanesthetized rabbits. Their conclusion was that ether has a potentiating effect on the neuromuscular blockade produced by neomycin.

In dogs,<sup>8</sup> 10 mg. per kg. of body weight of neomycin sulfate given intravenously, produced 100 per cent neuromuscular blockade (flaccid paralysis) and reduction in the respiratory minute volume to 10 per cent of the controls. Neostigmine antagonized these effects and pretreatment of mice and rabbits with intravenous neostigmine protected these animals from intravenous and intraperitoneal fatal doses of neomycin. Others<sup>7</sup> have applied this clinically. Pittinger and Long<sup>8</sup> state that intravenous concentrations of 0.2 mg. per cc. cause apnea and respiratory arrest.

Table 2 summarizes the cases of respiratory arrest following the use of intraperitoneal neomycin reported in the literature. An attempt has been made to correlate these cases in terms of

the amount of neomycin used, the concentration of the solution, the amount of neomycin per body weight (mg. per kg.), and what the author calls the postulated serum concentration, an estimate of what the serum concentration of neomycin could be if all of the intraperitoneally placed drug were absorbed into the blood stream at one time. This would then be a rough estimate of what the toxic serum levels would be. It is important to remember that the peritoneum does not actually work in that manner. In fact, when there is increased reaction in the peritoneal surfaces, as in peritonitis, the absorptive capacity may be less than when the peritoneum is normal. However, for purposes of discussion, the peritoneum will be assumed to be in direct communication with the venous system.

The intravascular component of the body is equivalent to 5 per cent of the body weight.<sup>8</sup> A 75-kg. man has an intravascular volume of 3750 cc., thus, by assuming that the total peritoneal dose is absorbed into the venous system, one can calculate the estimated intravascular concentration in mg. per cc. This has been done for each case, where possible, in table 2.

The A. M. A. Council on Pharmacy and Chemistry states that nephrotoxicity occurs at serum neomycin levels of 0.2 mg. per cc.<sup>1</sup> Pittinger and Long<sup>8</sup> state that respiratory arrest and apnea occur at levels of 0.2 mg. per cc. As can be seen from table 2, every case of respiratory arrest reported in the literature had a serum level above 0.2 mg. per cc. The levels ranged from 0.3 to 1.3 mg. per cc., and one was 750 mg. per cc. Therefore, the problem of toxicity was one of over-dosage.

#### AUTHOR'S USE OF NEOMYCIN

The author<sup>2</sup> has used neomycin sulfate solution as an irrigating solution in 203 cases over the past 2 years (1956-1958). Forty-four of these cases were contaminated or "dirty" cases in which the neomycin solution was used to irrigate the peritoneal cavity and the abdominal wall layers (table 3). Twenty-three cases were clean cases in which the neomycin was used for the peritoneal cavity and the abdominal wall layers (table 3). One hundred thirty-three cases were clean wounds in which only the muscular and subcutaneous layers were irrigated with the neomycin solution. Four cases were clean intrathoracic procedures in which neomycin was used intrapleurally as well as



TABLE 2

Summary of cases of respiratory arrest reported in the literature

Author	Age	Weight*	Total Amount	Concentration of Solution	Anesthetic	Result†	Neomycin per kg. of Body Weight	Postulated Serum Concentration
		lbs.	gm.				mg./kg.	mg./cc.
Pridgen <sup>12</sup>	4 mo.		0.5	"Dilute"	Ether	Apnea	100	2
	17 mo.	25	0.5	1 per cent	Gas-oxygen-ether		44	0.9
	28 years		3	1 per cent	Gas-oxygen-ether	Apnea	51	0.8
	48 years		3	"Dilute"	Gas-oxygen-ether	Apnea	40	0.8
Webber <sup>17</sup>	65 years		5	10 per cent	Cyclopropane, ether	Apnea	170	1.3
N.A.S.A. <sup>6</sup>	68 years		2	Not reported	Gas-oxygen-ether	Apnea, death	30	0.5
Poth <sup>11</sup>	1 day		15	5 per cent	?	Apnea	3750	750
Middleton <i>et al.</i> <sup>3</sup>	75 years		2	Not reported	Sodium pentothal, cyclopropane	Death	29	0.5
N.A.S.A. <sup>7</sup>	65 years		1	1 per cent	Cyclopropane, ether	Apnea, death	16	0.3

\* Where no weight was given in the report an estimate was made.

† Apnea took place in 15 to 30 min. after intraperitoneal administration.

TABLE 3

Author's cases of intraperitoneal use of neomycin sulfate solution

Contaminated cases (proved bacteriologically).....	44
Intestinal resection.....	10
Acute appendicitis.....	26
Intestinal obstruction.....	1
Colotomy.....	4
Gastric resection.....	3
Clean cases.....	23
Cholecystectomy.....	17
Common duct exploration.....	2
Laparotomy.....	3
Splenectomy.....	1

in the muscular and subcutaneous layers. In none of these was there any evidence of toxicity. In no clean case did any wound infection develop. A mild subcutaneous fat infection occurred in one "dirty" case (colotomy).

The above cases included infants as well as

older age group patients. The anesthesia used varied but all were done under either sodium pentothal, gas-oxygen-ether, cyclopropane, or open drop ether.

Because of the information referred to earlier with respect to the toxic serum concentration, the author decided to use a total dose for any single adult case of 500 mg. Of this total, no more than 250 mg. (and usually no more than 100 mg.) was ever placed in the peritoneal cavity. The remaining 250 to 350 mg. was used in the extraperitoneal layers where there is no absorption into the bloodstream. The solution was always in the concentration of 0.5 per cent. Thus in a 75-kg. man the potential total absorption of 20 to 50 cc. of the 0.5 per cent solution from the peritoneal cavity would produce a level of 0.03 to 0.07 mg. per cc., far below the toxic level of 0.2 mg. per cc. This dosage amounts to 1.3 to 3.3 mg. per kg. from the standpoint of the peritoneal cavity administration. The cases of toxicity reported in the literature (table 2) received from 16 to 170 mg. per kg., with one being given 3750 mg. per kg.

Experimentally, Pittinger and Long<sup>8</sup> found that, in dogs, 10 mg. per kg. of body weight produced paralysis and apnea, in ether anesthetized rabbits, 2 mg. per kg., and in unanesthetized rabbits, 20 to 40 mg. per kg.

In the infants and children of this series the body weight dosage was closely followed with respect to the intraperitoneal administration of the neomycin solution.

If ether anesthesia was being used, the lower range of dosages was used.

The total dose used intraperitoneally is almost certainly not absorbed. Aside from the limitations of the peritoneum as an absorbing membrane, some of the solution spills out of the peritoneal cavity, some is taken up by the packs and sponges, and some is evacuated by way of suction apparatus. Therefore, the actual dosage is usually less than that inserted.

#### DISCUSSION

The subcutaneous space is bacteriologically contaminated 58 per cent of the time in "clean" cases.<sup>2</sup> In another study the author found that neomycin solution irrigations (100 cc. of 0.5 per cent solutions) made these contaminated wounds become bacteriologically sterile in 73 per cent of the cases, as against 27 per cent following saline irrigations. In none of these "clean," but bacteriologically contaminated cases, did any infection develop.

The use of neomycin solution in the peritoneal cavity seemed especially logical in contaminated cases. It is the author's impression that 100 cc. of a 0.5 per cent solution is the maximum amount which should be used (or is necessary) in any one patient. Only 20 to 30 cc. of this should be used in the peritoneal cavity. This will produce a potential maximum blood level of 0.03 to 0.04 mg. per cc. As has been shown earlier, the toxicity of the cases reported in the recent literature is due to levels far and above the known toxic level of 0.2 mg. per cc. These cases have concentrations ranging from 0.3 to 1.3 mg. per cc., (table 2). The author's dosage amounts to 1 to 2 mg. per kg. of body weight. The cases of toxicity reported in the literature have dosages ranging from 16 to 170 mg. per kg. (table 2).

The abnormal discrepancy in dosages and concentrations points out the fact that any drug can be dangerous if used in excess of the basic phar-

macologically established safe dosages. In the case of neomycin, respiratory arrest was one of the factors used to determine the LMD in the early laboratory investigations.<sup>1, 14, 16</sup> Another example of this type of error, which many will remember, is the excessive intraperitoneal sulfonamide dosages which were used.

If used properly under the conditions described above, neomycin can be a valuable adjunct in contaminated surgical cases, and an important preventive in "clean" cases.

#### SUMMARY

1. The toxicity of neomycin sulfate is reviewed.
2. The reports of respiratory arrest in the literature are reviewed and analyzed from the standpoint of serum concentration and dosage per body weight.
3. The author's use of neomycin sulfate solution is presented and recommended dosages are given.
4. Overdosage is presented as the cause of respiratory arrest.

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#### REFERENCES

1. Council on Pharmacy and Chemistry: Report: neomycin sulfate. *J. A. M. A.*, 154: 338, 1954.
2. HOFFMAN, E., AND REBACK, J. F.: Subcutaneous space contamination. *Am. Surgeon*, 24: 364, 1958.
3. HOFFMAN, E.: Water, acid-base and electrolytes in surgery. *Sinai Hosp. J.*, 6: 23, 1957.
4. KADISON, E. R., VOLINI, I. F., HOFFMAN, S. J., AND FELSENFELD, O.: Neomycin therapy: its use in virus pneumonia, tuberculosis and diseases caused by Gram-negative bacteria. *J. A. M. A.*, 145: 1307, 1951.
5. MIDDLETON, W. H., MORGAN, D. D., AND MOYERS, J.: Neostigmine therapy for apnea occurring after administration of neomycin. *J. A. M. A.*, 165: 2186, 1957.
6. Newsletter of the American Society of Anesthesiologists: Case report. 21: 38, 1957.
7. Newsletter of the American Society of Anesthesiologists: Case report. 22: 33, 1958.
8. PITTINGER, C. B., AND LONG, J. P.: Danger of intraperitoneal neomycin during ether anesthesia. *Surgery*, 43: 445, 1958.
9. POTH, E. J.: Intestinal antiseptics. *West. J. Surg.*, 60: 205, 1952.
10. POTH, E. J.: Symposium on colonic surgery; intestinal antiseptics. *Am. J. Surg.*, 88: 803, 1954.
11. POTH, E. J.: Critical analysis of intestinal antiseptics. *J. A. M. A.*, 163: 1317, 1957.
12. PRIDGEN, J. E.: Respiratory arrest thought to

- be due to intraperitoneal neomycin. *Surgery*, 40: 571, 1956.
13. SCHATTEN, W. E.: Intraperitoneal antibiotic administration in treatment of acute bacterial peritonitis. *Surg. Gynec. & Obst.*, 102: 339, 1956.
14. SPENCER, J. N., PAYNE, H. G., AND SCHULTZ, F. H., JR.: Neomycin toxicity studies. *Fed. Proc.*, 9: 317, 1950.
15. WAKSMAN, S. A., KATZ, E., AND LECHEVALIER, H. A.: Antimicrobial properties of neomycin. *J. Lab. & Clin. Med.*, 36: 93, 1950.
16. WAKSMAN, S. A., AND LECHEVALIER, H. A.: Neomycin, a new antibiotic, active against streptomycin-resistant bacteria, including tuberculosis organisms. *Science*, 109: 305, 1949.
17. WEBBER, B. M.: Respiratory arrest following intraperitoneal administration of neomycin. *A. M. A. Arch. Surg.*, 75: 174, 1957.

## CHRONIC ATROPHIC GASTRITIS WITH MASSIVE HEMORRHAGE\*

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The literature is replete with descriptions of patients with epigastric distress to which the diagnosis of gastritis has been applied.<sup>1</sup> Many times this diagnosis is arrived at by exclusion of other diseases such as esophageal varices, peptic ulcer, hiatus hernia, or malignancy. Gastroscopic examination<sup>2, 3</sup> has been very useful in describing the appearance of the gastric mucosa in these conditions. Severe bleeding has been encountered in patients with hypertrophic gastritis.<sup>1, 4-6</sup> Bleeding from the stomach showing atrophic gastritis has been seen through the gastroscope but rarely is this bleeding severe.<sup>1, 5</sup>

All cases of upper gastrointestinal hemorrhage severe enough to warrant emergency laparotomy at the Veterans Administration Hospital, Dayton, Ohio from January 1950 through June 1957 were reviewed. A total of 89 cases were diagnosed as follows: duodenal ulcer, 61; gastric ulcer, 19; chronic gastritis, 1; bleeding hiatus hernia, 2; marginal ulcer, 5; and bleeding adenocarcinoma, 1.

A total of 78 cases for which the discharge diagnosis was chronic gastritis were treated at the Veterans Administration Hospital, Dayton, Ohio from January 1952 through June 1957. They were classified as follows: atrophic gastritis, 5; hypertrophic, 34; and nonspecific gastritis, 39.

The following case report is that of a patient with long standing symptomatic atrophic gastritis, with recurring episodes of severe bleeding eventually requiring subtotal gastric resection.

### CASE REPORT

J. A. S., a 61-year-old white male was first examined at the Veterans Administration Hospital, Dayton, Ohio on March 1, 1949 for symptoms of midepigastic pain which dated back to 1936. Food, bicarbonate of soda, and milk afforded symptomatic relief. He responded to medical management and was discharged as improved. An upper gastrointestinal examination during his second admission in November 1949, showed slight delay in emptying with small gastric

residue at 6 hr. Twelve-hour gastric analysis showed no free acid. Again he improved on ulcer medication and rest.

He was readmitted for the third time in May 1950. Gastric analysis on May 29 and June 2 showed no free acid. Cholecystogram, barium enema, and small bowel x-ray series were normal. An upper gastrointestinal x-ray series revealed no pathology. Stools were negative for blood. A gastroscopy revealed atrophic gastritis. The patient was discharged from the hospital to the Veterans Administration Center domiciliary as improved.

In 1951 he had mild hematemesis for which he was not hospitalized. In March, 1954 he experienced hematemesis with burning epigastric pain for which he was rehospitalized. Hemoglobin was 10.4 gm. per 100 ml.; hematocrit 34 volumes per 100 ml.; blood urea nitrogen, 24; and gastric analysis revealed no free acid. Stool was guaiac negative for blood, and no bleeding occurred following admission. A normal gastrointestinal series was obtained. On March 30, 1954, he was discharged from the hospital improved. In June 1954 he was readmitted to the Veterans Administration Hospital where he was seen for hematemesis. Hemoglobin was 9.8 gm. per 100 ml. with 34 volumes per 100 ml. hematocrit. No transfusions were required. He was discharged improved on July 9, 1954, with a diagnosis of (1) chronic atrophic gastritis, and (2) hemorrhage from the gastrointestinal tract, secondary to acute gastritis (irritative).

On March 1, 1956 he was again admitted to the hospital because of epigastric pain, hematemesis, and tarry stools. Physical examination showed hypertension of 220/110 mm. of Hg. Urinalysis was normal. No abdominal masses were felt. Rectal examination showed dark red blood on the examining finger. Bleeding, clotting, and prothrombin time were normal. Admission hemoglobin was 8.6 gm. per 100 ml. and 28 volumes per 100 ml. hematocrit; guaiac positive stools; and gastric analysis showing no free acid.

Because of the low hemoglobin and persistent tarry stools, he was given one unit of blood on March 3. Hemoglobin on March 5 was 11.6 gm. per 100 ml. and hematocrit was 39 volumes per 100 ml. A normal upper gastrointestinal x-ray series was reported on March 6. Gastroscopy on March

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12 showed severe chronic gastritis with areas of atrophic and hypertrophic gastritis, extreme hyperemia, and localized oozing (active bleeding).

On March 13, the hemoglobin was 8.1 gm. per 100 ml. and the hematocrit was 24 volumes per 100 ml. The patient was given two units of blood and on the following day a third unit was given. Three days later the hemoglobin was 10.0 gm. per 100 ml. and the hematocrit was 33 volumes per 100 ml. On March 18, the patient had tarry stools, bright red hematemesis with blood clots, and tachycardia. Dark red blood was obtained from the stomach through a Levin tube. The blood pressure dropped to 130/105 mm. of Hg. He received two units of blood and was taken to surgery where a gastric resection (75 per cent) was performed. On opening the stomach on the operating table, approximately 1000 cc. of blood with clots were removed. Atrophy of the stomach mucosa was noted by the surgeon. The liver was enlarged but otherwise normal in appearance.

The pathologist reported hypertrophy of the muscular layers of the stomach with round cell infiltration and mild atrophy of the gastric glands, with a diagnosis of chronic atrophic gastritis. The postoperative course was uneventful.

#### SUMMARY

The medical records of all patients with upper gastrointestinal hemorrhage for which emergency

laparotomy was performed from January 1950 through June 1957 and all cases of chronic gastritis treated from January 1952 through June 1957 at the Veterans Administration Hospital were reviewed.

This case report is our first experience in which massive bleeding occurred from chronic atrophic gastritis, severe enough to require a subtotal gastric resection.

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#### REFERENCES

1. FAIRLIE, C. W., JR.: Symposium on recent advances in medicine, chronic gastritis as source of gross hemorrhage; report and discussion of 4 cases. *M. Clin. North America*, 33: 1365, 1949.
2. BENEDICT, E. B.: Hemorrhage from gastritis; report based on pathological, clinical, roentgenological and gastroscopic findings. *Am. J. Roentgenol.*, 47: 254, 1942.
3. ANNIS, J. W.: Gastritis in military service. *Gastroenterology*, 2: 85, 1944.
4. SCHNEIDER, H., AND DAILEY, M. E.: Unusual type of gastritis. *Gastroenterology*, 10: 727, 1948.
5. RIDER, J. A., KLOTZ, A. P., AND KIRSNER, J. B.: Gastritis with veno-capillary ectasia as source of massive gastric hemorrhage. *Gastroenterology*, 24: 118, 1953.
6. PHEMISTER, D. B., AND HUMPHREYS, E. M.: Gastro-esophageal resection and total gastrectomy in treatment of bleeding varicose veins in Banti's syndrome. *Ann. Surg.*, 126: 397, 1947.



## BILIARY TRACT FISTULAE\*

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Abnormal communications between the extra hepatic biliary system and the skin or an abdominal viscus may be either the result of surgical therapy or these communications may be spontaneous. Before the introduction of gall bladder and liver surgery, biliary tract disease ran its course unmolested and bizarre fistulae were found at autopsy representing nature's attempt to drain the infected or the obstructed gall bladder.

At laparotomy, as an incidental finding, I have encountered old gallstones scattered throughout the abdomen and embedded around the colon and within the omentum owing to an old, untreated ruptured gall bladder in a patient who had never known he had had gall bladder disease. In the medical literature gallstones have been reported as being found in the pleural space, the pericardial cavity, the larger bronchi, the pregnant uterus, the large ovarian cysts, the urinary bladder, and even in the portal vein. Bizarre manifestations of cholelithiasis have become increasingly rare with the development of methods of accurate diagnosis of gall bladder disease and with prompt surgical intervention.

Surgically created biliary tract fistulae are quite common because of the many types of internal anastomoses which are made to maintain an adequate flow of bile into the gastrointestinal tract, and also because of temporary as well as permanent fistulae which are created to the skin when a T-tube is inserted into the common bile duct.

Cholecystectomy should be done if there is a history of jaundice, if there are palpable stones within the common duct, or if there is enlargement or thickening of the duct. X-ray evidence of stones within the common duct, history of frequent attacks of biliary colic, history of chills and fever, multiple small stones in the gall bladder with a dilated cystic duct, abnormal color of sediment within the bile duct seen on aspiration, and enlargement of the head of the pancreas may be indications to explore the common bile duct.

When a T-tube has been placed in the common duct following the removal of a stone, a definite postoperative routine should be adopted. A satisfactory example is that in about 10 to 14 days following surgery and when the inflammation and edema of the terminal end of the common duct incident to the surgery has subsided, the T-tube is clamped off for several hours. If there is pain following the clamping of the tube it usually indicates that there is some remaining obstruction of the lower biliary tract and the T-tube should not be removed at that time. One should wait a few more days, watching the stools for bile and waiting until the T-tube can be clamped off continuously without pain. A T-tube cholangiogram should then be done, and if there is no evidence of obstruction the tube may be removed. Where there is no further obstruction, the fistula usually drains for a few days after the removal of the tube following which the wounds heal. In a patient where there is obstruction persisting after the common duct exploration and the insertion of a T-tube, the obstruction may be due to a residual stone, a stricture, carcinoma of the head of the pancreas, or localized pancreatitis.

Gallstones are associated with 90 per cent of the spontaneous biliary tract fistulae. Perforating peptic ulcers are responsible for five per cent, cancer is an occasional cause of a spontaneous fistulae and degenerative necrosis of the immediate surrounding viscera also may occasionally result in a biliary tract fistula. There are other more rare causes of these spontaneous fistulae. Various types of biliary fistulae may also result from trauma.

Intra-abdominal carcinoma, particularly carcinoma of the pancreas and carcinoma of the stomach, are frequent causes of biliary tract obstruction. Many types of palliative biliary internal fistulae are surgically created, including anastomosis of the gall bladder or common bile duct to the stomach, duodenum, or a loop of jejunum. The more acceptable type of palliative biliary fistula is that of the Roux-Y type choledochojejunostomy and jejunojejunostomy.

\* Presented during the Baltimore Assembly of The Southeastern Surgical Congress, March 10-13, 1958, Baltimore, Maryland.

This produces a free flow of bile into the small intestine without allowing the regurgitation of intestinal contents into the biliary tract. An anastomosis between the common bile duct, particularly when the bile duct is dilated due to obstruction, is usually preferable to an anastomosis of the gall bladder which may later become diseased and obstructed. When the duodenum or head of the pancreas is resected and when there is no biliary tract obstruction and, of course, no dilatation of the common duct, it may be wise, if the gall bladder is not diseased, to do both a cholecystojejunostomy and a choledochojejunostomy in an attempt to prevent further difficulties and jaundice which may result if one of the anastomoses becomes obstructed. A more rare type of lesion in which a surgical biliary fistula is created, is that of a choledochal cyst in which case some type of choledochointerostomy is done, usually a choledochoduodenostomy.

Spontaneous internal biliary tract fistulae are a complication of long standing disease of the biliary tract. In a review of the early medical literature it is evident that a preoperative diagnosis of such an internal fistula was rarely made, or even suspected. By keeping the possibility of this type of fistula in mind and by resorting to x-ray studies, it is now not uncommon to make the diagnosis preoperatively. Most of these patients are females in their sixth or seventh decade of life, who have had long standing complaints suggestive of chronic gall bladder disease. The majority of these patients with biliary fistulae have had attacks of biliary colic, often with severe pain. Occasionally after a prolonged attack of colic or subacute cholecystitis associated with jaundice, both the pain and the jaundice may subside. If this improvement of symptoms of biliary tract disease is followed by lower abdominal pain, diarrhea or other signs of gastrointestinal distress, then the possibility of an internal spontaneous biliary fistula should be suspected. The finding of large gall stones in the feces of patients with severe biliary tract disease should immediately make one suspect a fistulous communication between the gall bladder and the colon. Very large stones rarely pass through Vater's papilla and if a large stone should enter the small bowel by a fistula it will invariably lead to a gall stone ileus. In patients with a cholecystocolic fistula, chills, fever, weight loss, and diarrhea are often present and sometimes large

amounts of bile are passed in the stools causing irritation and tenesmus.

#### CASE REPORTS

##### *Fistula from Gall Bladder via Compound Fracture of the Right Iliac Crest*

*Case 1.* E. R., a 23-year-old soldier, was injured by enemy machine gun fire in Korea. He was evacuated by tank and helicopter. Exploratory laparotomy 30 hr. after his injury revealed four perforations of the distal ileum; an avulsion of the ascending colon and a compound comminuted fracture of the right iliac crest. The terminal ileum and the right colon were resected and a colostomy was done. Postoperatively he developed a fistula between the gall bladder and the ileum. A segment of the ileum was resected, the colostomy closed, and the gall bladder was drained for a few days. He then developed drainage from the right iliac bone at the site of the fracture. Loose bone fragments were removed and later a sequestrectomy was done. Because of the continued drainage, Lipiodol was injected into the tract. X-ray examination suggested an osteomyelitis of the crest of the ileum. The sinus tract to the iliac bone was excised and the bone exposed and curetted. No sequestrae were found. The wound was packed open. An attempt at secondary closure was followed by a recurrence of drainage. Lipiodol was again injected into the tract. It showed a fistula between the gall bladder and the skin by way of the iliac bone (fig. 1). The gall bladder was removed and the fistula excised. He has had no further difficulty.

##### *Carcinoma of Duodenum Arising from Aberrant Pancreatic Tissue*

*Case 2.* L. R., a 47-year-old white female, was admitted to the hospital complaining of pain in the right upper abdominal quadrant with some radiation to the right costovertebral angle. There was no evidence of jaundice. The patient was explored through a transverse upper abdominal incision and a mass was found within the second portion of the duodenum. The duodenum was opened and biopsy showed carcinoma of the second portion of the duodenum arising from aberrant pancreatic tissue. There was no involvement of Vater's ampulla and there was no obstruction of the biliary tract or dilatation of the common bile duct. A resection was done of the lower stomach, the lower end of the common bile duct, the head and neck of the pancreas, the entire duodenum, and a small portion of the jejunum. A Roux-Y type of procedure was then done and the end of the jejunum was then anas-

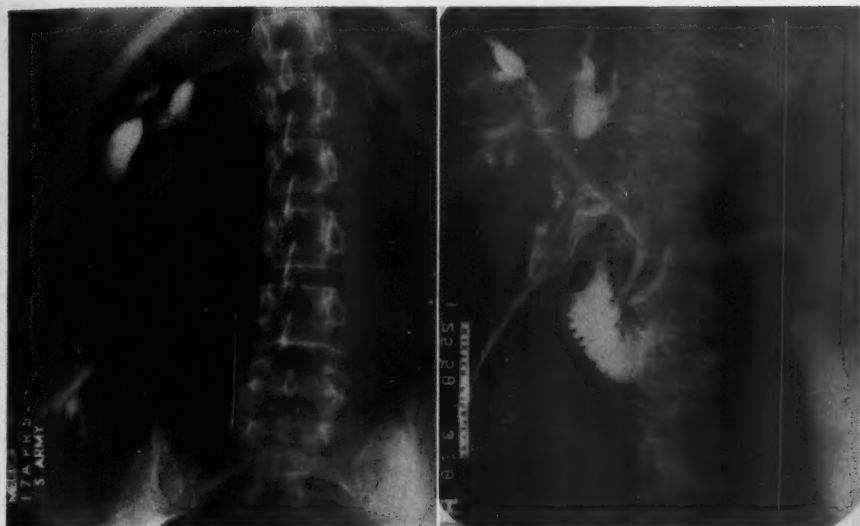


FIG. 1 (Left). Roentgenogram from case no. 1, showing a fistulous connection between a compound fracture site of the right iliac bone with the gall bladder.

FIG. 2 (Right). Postoperative x-ray of case no. 3, following curettage of carcinoma obstructing both hepatic ducts and T-tube drainage. Some remaining dilatation of the hepatic ducts is noted, with free flow of dye into the duodenum. There is filling of Wirsung's pancreatic duct to the point of involvement of the duct by carcinoma of the body of the pancreas.

tomosed to the neck of the pancreas so that the jejunum was fitted over the pancreas as a cap. Since there was no obstruction or disease of the biliary tract and no dilatation of the common duct, both a choledochojejunostomy and a cholecystojejunostomy were done to provide a free flow of bile into the small intestines. A gastrojejunostomy and jejunojejunostomy completed the procedure. The pathologic report showed infiltrating carcinoma of the pancreas arising from aberrant pancreatic tissue in the duodenal mucosa extending into the duodenal muscularis with lymphatic permeation. One regional lymph node showed metastatic adenocarcinoma. The remainder of the lymph nodes were negative. This patient has been asymptomatic for 3½ years.

#### Bilateral Hepatic Duct Obstruction

Case 3. G. W., a 57-year-old white male, with a known carcinoma of the body of the pancreas was admitted with a chief complaint of marked jaundice. It was believed preoperatively that he had developed common duct obstruction due to carcinoma of the pancreas involving Vater's ampulla. He was explored with the idea of doing a palliative Roux-Y type of choledochojejunostomy. At exploration there was found an obstruc-

tion of both the right and left hepatic ducts at the hilum of the liver due to metastasis from carcinoma of the body of the pancreas. The head of the pancreas and Vater's ampulla were not involved in the neoplasm, there was no obstruction of the common duct at its distal end, and no dilatation of the duct. The common duct distal to the obstructed area and both hepatic ducts were identified and opened. A small probe was passed through the obstructed portion of the common hepatic duct and into the right hepatic duct within the right lobe of the liver. As this probe was forced through the tumor a few drops of bile were obtained. The opening was gradually dilated with dilators and then the tumor was curetted from within the hepatic duct until a free flow of bile was obtained. A similar type procedure was then done in the left hepatic duct. A T-tube was sutured within the common duct thus allowing a palliation of the obstructive jaundice. A postoperative cholangiogram through the T-tube outlined both hepatic ducts and showed a free flow of dye into the duodenum (fig. 2).

#### Hepatic Duct Cyst

Case 4. V. W., a 1½-year-old white girl with intermittent obstructive jaundice, suffered from

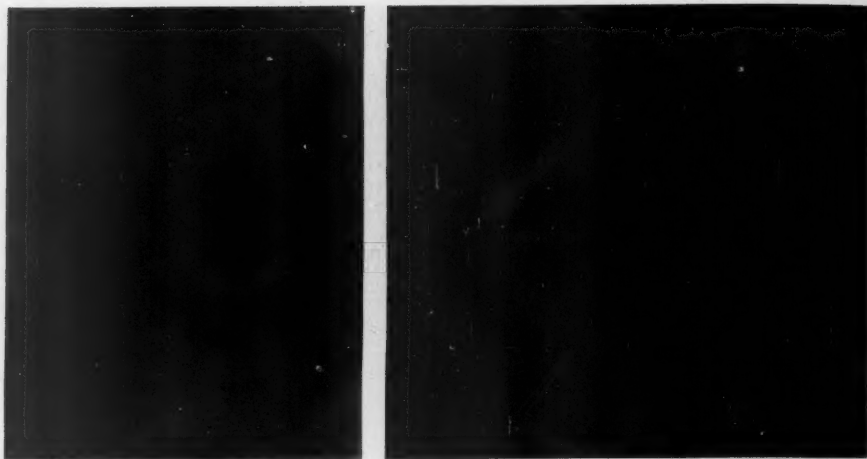


FIG. 3 (Left). Preoperative intravenous cholangiogram from case no. 4, showing a cystic dilatation of the hepatic duct and slight enlargement of the gall bladder due to intermittent obstruction. (Right) Postoperative cholangiogram of this 1½-year-old girl after choledochoduodenostomy and cholecystectomy, showing remaining dilatation of the bile duct but free flow of dye to the duodenum.

diarrhea, abdominal pain, and vomiting. Her examination was unremarkable except for jaundice and enlargement of the liver. Cholecystogram and intravenous cholangiogram showed a cystic dilatation of the hepatic duct with a slight enlargement of the gall bladder. She was explored and a cyst of the hepatic duct and a narrowing of the lower end of the common duct was found. An internal biliary fistula was created by doing a choledochoduodenostomy and a temporary external fistula was also created by doing a cholecystostomy. Postoperative cholangiogram showed some remaining dilatation of the bile duct, and free flow of dye into the duodenum (fig. 3). Her jaundice has remained completely relieved.

#### *Common Duct Cyst*

*Case 5.* P. S., a 1-year-old colored female, was admitted with a history of jaundice, dark urine, vomiting, and abdominal distention. The abdomen was distended and tympanitic and there was a slight umbilical hernia. A mass in the right upper retroperitoneal area was thought to be an obstruction of the right ureter with right hydronephrosis, however exploration revealed a cyst of the common bile duct. About three-fourths of the common duct cyst was removed and the remainder of the cyst anastomosed to the duodenum. A T-tube was placed in the common bile duct. The T-tube was removed two weeks following surgery.

#### *Common Duct Diverticulum*

*Case 6.* C. E., an 82-year-old white male, was admitted with a diagnosis of obstructive jaun-

dice. His liver was enlarged four finger breadths below the right costal margin. Intravenous cholangiogram failed to visualize the biliary tract. At surgical exploration a distended gall bladder containing multiple stones was found. The gall bladder was removed and the common bile duct was explored. Numerous stones were removed from both the common duct and the left and right hepatic ducts. An outpouching was then found in the posterior wall of the common bile duct, which was filled with a muddy, claylike material. This was felt to be either a congenital diverticulum of the common bile duct or a pseudo-diverticulum formed by stones. A T-tube was placed in the common duct. Postoperative T-tube cholangiogram showed no further obstruction of the biliary tract and the unusual outpouching from the distal end of the common bile duct which represented a diverticulum (fig. 4). After removal of the T-tube the patient had no further evidence of biliary obstruction.

#### *Reduplication of Common Duct*

*Case 7.* M. B., a 75-year-old white female, was admitted with a history of recurrent attacks of chills associated with nausea and vomiting. She did not complain of abdominal pain and, on examination, there was no definite tenderness of the abdomen and no palpable masses. She was explored and in addition to finding a diseased gall bladder containing numerous stones, there were stones palpable within the common duct. The common duct was opened and the stones removed.

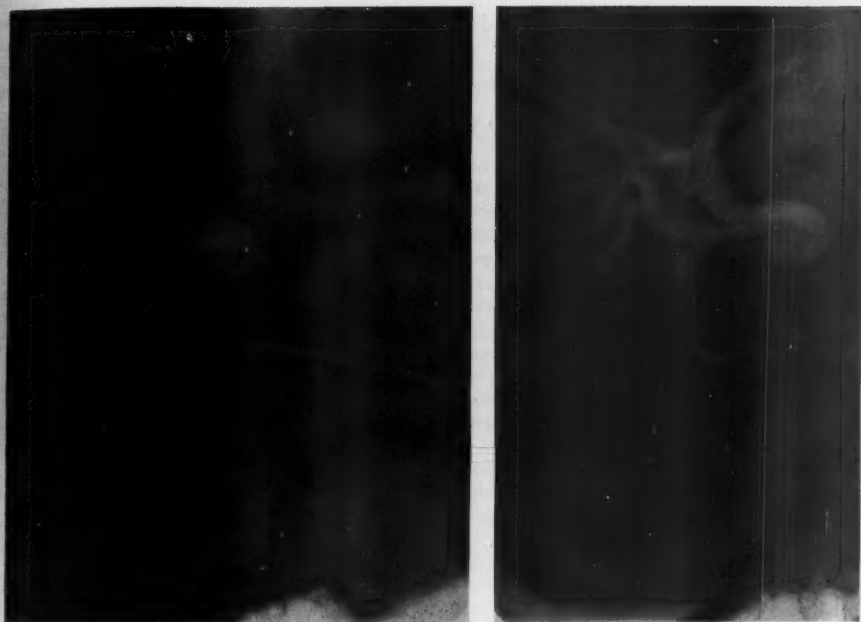


FIG. 4. T-tube cholangiogram of case no. 6, showing an unusual outpouching of the distal end of the common duct, representing a diverticulum.

A probe was placed downward into the duodenum without encountering further obstructions. Additional stones could be palpated, however, and there was found to be a reduplication of the common duct, therefore, an opening was made in the proximal portion of the reduplicated duct and additional stones removed. A T-tube was placed into each of these ducts and brought out through a stab wound. The patient did well postoperatively. A postoperative cholangiogram showed reduplication of the common bile duct and no evidence of further obstruction (fig. 5).

#### *Cholecystocutaneous Fistula*

**Case 8.** M. A., a 49-year-old white female, had been admitted seven months previously with a gangrenous gall bladder and shock. At that time an emergency cholecystostomy was done. She did well following this emergency surgery. After dismissal from the hospital, she again developed a mass in the right upper quadrant of the abdomen. She was readmitted and a subcutaneous biliary abscess was drained. This again healed, but subsequently she developed a cholecystocutaneous biliary fistula. She was readmitted and under general anesthesia the cholecystocutaneous biliary fistulous tract was excised and a cholecystec-



FIG. 5. Roentgenogram on case no. 7, illustrating a T-tube in each portion of a reduplicated upper end of the common bile duct in a 75-year-old female who had had stones obstructing both portions of this reduplicated duct.



tomy was done. Following this she has had no further biliary tract symptoms.

#### *Residual Cystic Duct with Stone Formation*

*Case 9.* A. C., a 44-year-old white female, was admitted with a history of recurrent attacks of upper abdominal pain. Her gall bladder had been removed approximately 10 years prior to this admission. An intravenous cholangiogram revealed a stone in the common duct. The common duct was explored. It was dilated and the walls were thickened. A soft stone could be palpated within the distal portion of the common duct. A residual cystic duct measuring approximately 4 cm. in length was isolated and divided close to its entrance into the common duct. The stone was removed from the common duct and a T-tube was inserted. It was felt that the stone had formed in the residual cystic duct and had passed into the common duct causing the biliary obstruction. The pathologic report showed a cystic duct stump and a fragmented calculus. Cholangiogram through the T-tube revealed good drainage into the duodenum with no further biliary obstruction.

#### *Common Duct Stricture*

*Case 10.* E. L., a 40-year-old white female, was admitted with a complaint of recurrent attacks of right upper quadrant abdominal pain and a long history of indigestion. She had no history of jaundice or clay colored stools. On x-ray examination, there was found to be numerous stones in the gall bladder. A cholecystectomy was done. The common duct was not explored. Postoperatively she developed persistent jaundice. Re-exploration revealed that the common bile duct had been ligated and divided during her cholecystectomy. The proximal and distal ends of the duct were identified and the edges trimmed. An end-to-end anastomosis was done. A T-tube was placed in the common duct above the area of anastomosis. The duodenum was then sutured to the posterior portion of the hepatoduodenal ligament to relieve tension on the anastomosis. On the ninth postoperative day, a T-tube cholangiogram with 35 per cent Diodrast injected into the T-tube showed good position of the T-tube with filling of both the hepatic ducts and the common bile duct, and emptying of the dye into the duodenum. The patient developed an allergic reaction to the Diodrast with resultant edema of the distal end of the common bile duct. The edema subsided. The T-tube was subsequently removed. The patient has had no further biliary tract symptoms.

#### *Stone in Vater's Ampulla*

*Case 11.* R. E., a 57-year-old white female, was admitted with a history of recurrent right upper

abdominal pain. Following admission to the hospital she developed jaundice. On abdominal exploration the gall bladder was found to be quite thick and necrotic at its base. The common bile duct was slightly dilated, but no stones were palpable. The gall bladder was removed and the common duct was explored, but no stones were found. The duodenum was opened through a longitudinal incision and Vater's ampulla explored. A stone entirely covered with mucosa was found buried within Vater's ampulla. A sphincterotomy was done and the stone removed. A T-tube was placed in the common duct. The patient had an uneventful postoperative recovery.

#### *Pancreatitis with Obstructive Jaundice*

*Case 12.* T. E., a 66-year-old white male, was admitted complaining of intermittent attacks of abdominal pain, associated with nausea, anorexia, sudden onset of jaundice, and clay colored stools. Abdominal exploration revealed evidence of chronic inflammation of the gall bladder with one large stone. The head of the pancreas was thickened as well as the body and tail. The duodenum was explored and the pancreas biopsied. This showed acute pancreatitis with fat necrosis. The gall bladder was removed and a T-tube was placed in the common bile duct. He did well postoperatively and his jaundice slowly disappeared.

#### *Cholecystogastrostomy*

*Case 13.* C. B., a 67-year-old white female, had complained of generalized malaise for several years. She had become deeply jaundiced several weeks prior to her admission to the hospital and had developed generalized itching of her skin. Her stools were clay colored and her urine was darkly stained. Aspiration biopsy of the liver had been reported as showing normal liver tissue. On examination, the liver was enlarged, the gall bladder was distended, and she was markedly icteric. On exploration she was found to have a scirrhus type carcinoma of the pancreas, involving both the head and the body. A palliative type internal biliary fistula was planned. It was found that the stomach was much more easily delivered up to the point of the tense gall bladder than the duodenum. Therefore, a cholecystogastrostomy was done for palliation of her biliary obstruction.

#### *Choledochoduodenal Fistula*

*Case 14.* C. M., a 50-year-old white male, was admitted with a left indirect inguinal hernia and was found to have an internal biliary fistula between the common bile duct and the duodenum. A gastrointestinal series was done which showed an internal biliary fistula between the first portion

of the duodenum and the biliary tree (fig. 6). There was slight displacement of the second portion of the duodenum due to an inflammatory mass. It was felt that the biliary fistula had been caused by a

perforated ulcer. The left inguinal hernia was repaired. The patient was discharged without treatment of his asymptomatic biliary fistula.

#### *Cholecystojejunostomy*

*Case 15.* C. S., a 47-year-old white male, had had a gastric resection for adenocarcinoma of the stomach with metastases to the regional lymph nodes one year prior to this hospital admission. Two weeks prior to admission he developed jaundice and right upper quadrant and epigastric pain. The liver was enlarged three finger breadths below the right costal margin. He was explored and found to have metastatic carcinoma causing obstruction of the distal common bile duct. A cholecystojejunostomy was done for palliative relief of the obstructive jaundice.

#### *Cholechojejunostomy*

*Case 16.* V. H., a 30-year-old white female, had complained of right upper quadrant abdominal pain for the past 1½ years. An episode of jaundice one year previously had been diagnosed as hepatitis. Seven weeks prior to this admission a cholecystectomy for gallstones was done at another hospital. Three days following her cholecystectomy, she became progressively jaundiced. On admission to this hospital she, in addition to being icteric, was tender in the epigastrium and right



FIG. 6. Gastrointestinal series, from case no. 14, showing a spontaneous choledochoduodenal fistula caused by a perforated peptic ulcer.

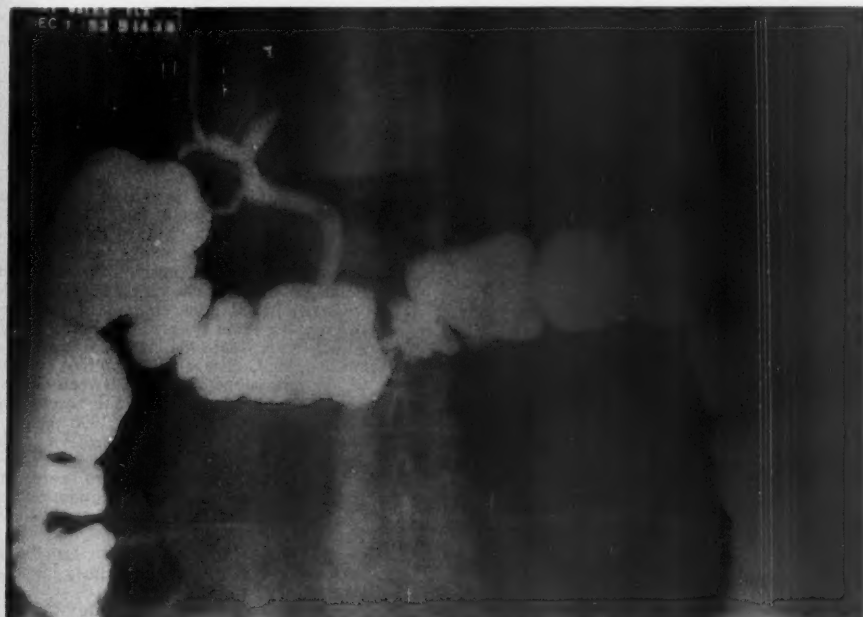


FIG. 7. Barium enema, from case no. 17, illustrating spontaneous cholecystocolic fistula.

upper quadrant. The liver was moderately enlarged. On abdominal exploration a retroperitoneal biliary abscess was encountered containing approximately one pint of thick bile. There were massive adhesions around her stomach, colon, duodenum, omentum, and gastrohepatic ligament. Because of the extremely dense scar tissue, it was not possible to palpate or visualize the common duct. The duodenum was opened and a probe was passed through Oddi's sphincter after a sphincterotomy was done. Complete blockage of the common bile duct approximately 1.5 cm. below the bifurcation of the hepatic duct was found. The stump of the proximal common duct was mobilized, however, due to marked scarring of the distal portion of the common duct. An end to end anastomosis was impossible. A Roux-Y type of choledochojejunostomy was done following which the distal end of the common duct was ligated with a silk ligature. The retroperitoneal biliary abscess was drained. Although the patient had a stormy postoperative course, she recovered.

#### *Cholecystocolic Fistula*

*Case 17.* L. C., a 66-year-old white female, complained of recurrent upper abdominal pain. She had had one episode of diarrhea and left upper quadrant pain. A barium enema showed a fistula between the colon and the gall bladder (fig. 7). Abdominal exploration revealed a fistula between the transverse colon near the hepatic flexure and the gall bladder at the fundus. After the fistulous tract between the gall bladder and the transverse colon had been isolated, it was divided and the opening in the colon was closed. The gall bladder was removed. The pathologic report was that of chronic cholecystitis and cholecystocolic fistula. Postoperatively she did well and was discharged without further complications or discomfort.

#### *Cholecystocolic Fistula with Gallstone Acting as Ball Valve*

*Case 18.* C. W., a 50-year-old apparently healthy farmer, with a presenting complaint to the effect that suddenly and without warning, intermittently and irregularly, his bowels would move. He would have a slight pain, followed by a spontaneous and copious bowel movement. These episodes varied from several hours to three weeks. In the meantime, his bowels would move quite normally and regularly without any disturbance or distress. Close questioning brought out the fact that two things would tend to precipitate an attack: (1) when he was working in a stooped over position; and (2) immediately following sexual intercourse.

Eight years previously he had had a perforated gall bladder with stones. At that time free stones were removed from the abdominal cavity, however, the gall bladder was not removed. He recovered and had been free of symptoms for approximately eight years until the development of the symptoms noted above. A cholangiogram showed a stone approximately  $\frac{3}{4}$  in. in diameter in the gall bladder. With the dye still in the gall bladder, a barium enema was given. A small peaking from the colon was present that pointed directly to the gall bladder which lay at the point of this peak. Abdominal exploration revealed a fistula between the gall bladder and the colon. The gall bladder contained a large stone. This created a ball valve, so that in certain positions the stone rolled off the fistula's opening causing a sudden release of bile into the colon and thereby producing a sudden bowel movement. The gall bladder was removed and the colon was repaired. The patient has had no further biliary or intestinal symptoms.

#### SUMMARY

Cases illustrating various types of surgical, traumatic, and spontaneous biliary fistulae are presented. Corrective operative procedures are presented. Spontaneous biliary fistulae are usually the result of gallstones, perforating peptic ulcers or carcinoma. If there is x-ray evidence of air or barium within the biliary tree, a diagnosis of an internal biliary fistula can be made.

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#### REFERENCES

1. BENNETT, L. C., AND HEWKO, J.: Cholecystoduodenal fistula. *Am. J. Surg.*, 83: 228, 1952.
2. BOGETTI, M.: Fistola biliare esterna da occlusione del coledoco consecutiva a colecistectomia. *Epatico - digiunostomia*. Guarigione. *Minerva chir.*, 5: 442, 1950.
3. BOOKMAN, M. R.: Carcinoma of duodenum originating from aberrant pancreatic cells. *Ann. Surg.*, 95: 464, 1932.
4. CARLSON, E., GATES, C. Y., AND NOVACOVICLI, G.: Spontaneous fistulas between the gall bladder and gastrointestinal tract. *Surg. Gynec. & Obst.*, 101: 321, 1955.
5. COLE, W. H.: Pre- and postoperative fistulas. *Postgrad. Med.*, 2: 47, 1947.
6. COSTANTINI, A.: Fistola biliare persistente dopo colecistectomia; fistoloduodenostomia. Guarigione. *Boll. e mem. Soc. piemontese chir.*, 16: 486, 1946.
7. DONALD, D. C., MEADOWS, B. T., AND SILBERMANN, S. J.: Air in the biliary passages. *Arch. Surg.*, 53: 652, 1946.
8. DUFF, J. L.: Personal communication.
9. DUFF, G. L., FOSTER, H. L., AND BRYAN, W. W.: Primary carcinoma of the infra-

- ampullary portion of the duodenum, with example of probable origin from aberrant pancreatic tissue. *Arch. Surg.*, 46: 494, 1943.
10. ELIASON, E. L., AND STEVENS, L. W.: Spontaneous internal biliary fistula. *Am. J. Surg.*, 51: 387, 1941.
  11. ILGENFRITZ, H. C.: Internal biliary fistula. *New Orleans M. & S. J.*, 104: 538, 1952.
  12. JORDAN, P. H., JR., AND STIRRETT, L. A.: Treatment of spontaneous internal biliary fistula caused by duodenal ulcer. *Am. J. Surg.*, 91: 307, 1956.
  13. SANDERS, R. L., AND PORTER, C. H.: Palliative operations for carcinoma of the pancreas. *South. Surgeon*, 15: 383, 1949.
  14. SMITH, D. W., GREENFIELD, M. M., AND GOULD, M. G.: The diagnosis of spontaneous internal biliary fistulas and the complication, gallstone ileus. *J. Florida M. A.*, 37: 347, 1950.
  15. STAPLER, N. M., D'ALOTTO, U., AND DOYLE, J.: Las fistulas biliares internas. *Prensa méd. argent.*, 33: 343, 1946.
  16. TAYLOR, W. B.: Internal biliary fistulae. *Canad. M. A. J.*, 47: 332, 1942.
  17. TRABUE, C. C., IV: Choledochotomy and cholangiography. *Am. Surgeon*, 23: 729, 1957.
  18. TSARDAKAS, E. N., AND ROBNETT, A. H.: Internal biliary fistula. *Cleveland Clin. Quart.*, 23: 124, 1956.
  19. WALTERS, W.: Diseases of the gall bladder and bile ducts. *Surgical aspects. A. M. A. Arch. Surg.*, 72: 199, 1956.

# A CASE OF BILATERAL FEMORAL ANEURYSM WITH REFERENCE TO SIZING AS A FACTOR IN ARTERIAL GRAFTING\*

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It is increasingly apparent that satisfactory synthetic vascular prostheses will be found. The requisite properties of these prostheses are defined but not to the final critical degree. The case reported here serves to emphasize the importance of integrating pathophysiologic hemodynamics with morbid anatomic change relative to the type of prosthesis employed.

In discussing practical considerations of vascular grafting, Linton<sup>1</sup> mentions the need for a large assortment of substitute vessels in order that proper sizing with the host might be achieved. The difficulty in achieving such voluminous blood vessel stores is apparent, thus, a search for a synthetic vessel is mandatory.

In 1956, Creech and his associates<sup>2</sup> collected and reported surgical experiences with synthetic vascular replacements. This group concluded that essential properties of synthetic vessels were: "...inertness, flexibility, ability to retain shape, and ease of handling." Elasticity was not considered important and porosity was enigmatic.

More recently, Crawford and his associates<sup>1</sup> have reported a large series of cases in which synthetics were employed. Perhaps their Dacron tube will be the synthetic of choice.

Despite a reasonable respect for exactness in all things surgical, the factor of error demands a place in every calculation. Thus the most reasonable compromise for an individual problem can be defined.

## CASE REPORT

W. L., a 75-year-old colored male was first noted to have significant vascular disease in August 1957. At that time, an aneurysm of the right superficial femoral artery was discovered. A careful examination was directed at discovery of other lesions. This was fruitless. The patient deferred

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surgery. On January 24, 1958, he entered the hospital complaining of pain and tenderness in the left leg. The tenderness was along the course of Hunter's canal and suggested an early phlebitis.

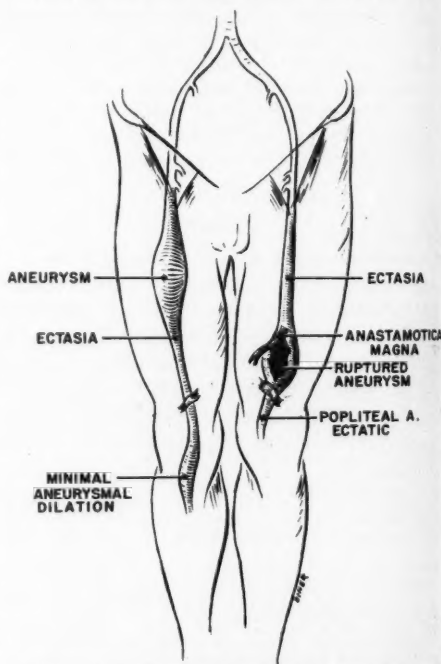


FIG. 1. Composite diagram illustrating the total problem. Note the peculiar, diffuse ectasia. This was evident on arteriograms but because of various unknowns, was not properly appreciated. Microscopically, these vessels were composed entirely of a thin fibrous tissue undoubtedly predisposing to the poststenotic dilatation which occurred. Note, on the left, the compromise of the superior geniculate.

Four days after onset, deep induration and a mass were noted in the lower medial thigh. The distal pulses on the left foot—never strong—disappeared. At this time the diagnosis of an abscess was made and drainage advised. An alert house officer, however, felt that this diagnosis was uncertain and deferred drainage. Finally



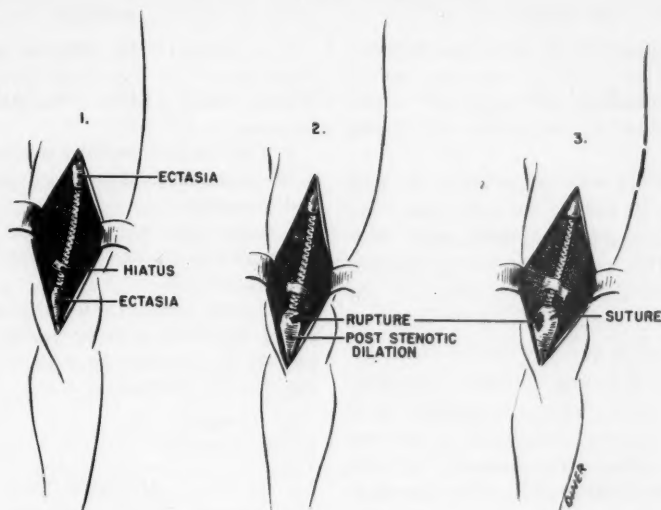


Fig. 2. The osseo-aponeurotic hiatus was resected but appears as a point of reference. 1. Appearance at conclusion of original surgery. 2. First "blowout" in poststenotic balloon. 3. Final appearance before amputation. The actual size ratio of graft to host vessel was  $2/3$ . In retrospect, this is a mathematic reduction in cross-sectional area of 45 per cent.

aspiration was accomplished and blood under considerable pressure was recovered. The mass had progressed to such a degree that compression of remaining collaterals as well as direct pressure had caused severe circulatory impairment of the thigh and leg distally. It was at this point (eight days after onset of the present illness) that consultation was requested regarding what was now believed to be a ruptured aneurysm (fig. 1). Despite obvious dangers, the deteriorated condition of the patient necessitated further delay in surgery.

On February 4, 1958, surgery was undertaken. A huge laminated clot was removed from the intermuscular planes. This was secondarily infected and massive muscle necrosis required wide débridement. A large arteriosclerotic aneurysm of the femoro-popliteal area had ruptured. There was very little back bleeding distally but run-off was figured to be fair as a catheter could be passed distally without obstruction. Fully realizing the hazards involved, a Tapp-Edwards graft was inserted. Considerable trepidation centered on the selection of the prosthesis. The femoral artery was extremely ectatic and proper sizing with available material was impossible. It was feared that the "too large" prosthesis would slow the blood column and encourage thrombosis: therefore the "normal" femoral artery size was inserted (fig. 2-1). Suture lines were not wrapped as excess foreign body was undesirable. At the conclusion

of the procedure the extremity was noticeably warmer.

In view of the hazardous bed in which the graft lay, a sterile tray was placed at the patient's bedside containing the essentials for atraumatic occlusion of the common femoral artery. This artery was loosely covered by skin so as to be readily available.

A massive hemorrhage occurred and re-exploration was carried out 36 hr. postoperatively. The graft was found patent and the suture lines intact. Three millimeters distal to the lower suture line there was a 2 mm. "blowout." The area was remarkably dilated and thin walled (fig. 2-2). Thus a poststenotic dilatation had been produced which led to the "blowout." A single suture closed the defect and the procedure was terminated. Soft tissue was utilized as well as possible to buttress the area. Wrapping was again rejected.

Eight days passed uneventfully, the circulation remaining amazingly good. Then on February 14, 1958, ten days after the original surgery, another hemorrhage ensued. Reoperation revealed another "blowout" in the poststenotic aneurysm (fig. 2-3). Again the graft was patent and the suture lines intact. Necrosis and infection were found progressive at this time and amputation was performed.

On March 24, 1958, the right femoral aneurysm was resected and almost exact sizing was achieved as further material had been purchased. Recovery was uneventful. The immediate result is good.

## DISCUSSION

The dilemma of arterial sizing was apparent in this case. That a wrong choice was made is evident. Unfortunately this experience cannot be directly utilized in the presence of differing pathology.

Obviously if one is to size properly, the graft must not only be a static but a dynamic "fit." Since even homografts do not retain their dynamic quality it appears to be a practical impossibility to size perfectly. Moreover, the host vessel will present infinite variables in dynamics which in turn are dependent on the pathologic and physiologic status of the entire cardiovascular tree. Thus the problem is to determine the per cent and direction that error will take. This will, of course, depend on the qualities of the graft. In other words, will a "too large" graft dilate in response to the narrow inflow channel, etc.

The problem of thrombosis in an oversize graft is probably not significant if high pressure inflow is maintained and run-off good. This problem, then, increases as one moves distally on the arterial tree.

It is suggested that an inelastic, exact, or slightly oversized synthetic vascular prosthesis should be preferred. If one desires to risk post-stenotic changes to gain added assurance against thrombosis in peripheral grafts, it would appear that the distal vessel should be wrapped with an appropriate material.

## SUMMARY

1. A patient with bilateral arteriosclerotic aneurysm of the superficial femoral artery in Hunter's canal is reported. Spontaneous rupture occurred on the left.

2. The synthetic vascular prosthesis employed in this case evidenced good resistance to infection and thrombosis.

3. Sizing with the host vessel in grafting must be as exact as possible due to the "fixed" nature of the prosthesis.

4. If sizing is to fail in the ideal, a slightly "too large" prosthesis is to be preferred. This may actually be preferable to exact sizing because of the dynamic differential.

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## REFERENCES

1. CRAWFORD, E. S., DeBAKEY, M. E., AND COOLEY, D. A.: Clinical use of synthetic arterial substitutes in three hundred seventeen patients. *A. M. A. Arch. Surg.*, 76: 261, 1958.
2. CREECH, O., JR., DETERLING, R. A., JR., EDWARDS, S., JULIAN, O. C., LINTON, R. R., AND SHUMAKER, H., JR.: Vascular prosthesis; report of the Committee for the Study of Vascular Prosthesis of the Society for Vascular Surgery. *Surgery*, 41: 62, 1957.
3. JULIAN, O. C., DYE, W. S., JAVID, H., AND GROVE, W. J.: The use of vessel grafts in the treatment of popliteal aneurysms. *Surgery*, 38: 970, 1955.
4. LINTON, R. R.: Some practical considerations in the surgery of blood vessel grafts. *Surgery*, 38: 817, 1955.
5. McALLISTER, F. F.: Experiences with replacement of segments of diseased femoral and popliteal arteries. *Surgery*, 38: 964, 1955.

## MALIGNANT MELANOMA: AN ANALYSIS OF 135 CASES\*

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Since its opening in 1932, 135 patients with malignant melanoma have been treated in the Tumor Clinic of the Confederate Memorial Hospital (formerly Shreveport Charity Hospital). These patients have been reviewed and their analysis is herewith reported. It is not our purpose to present an exhaustive survey of the literature and those interested in such reviews are referred to the previous reports of other authors.<sup>4, 8, 9, 13</sup>

Melanoma is one of the rarer tumors and the extent of reported series indicates the difficulty of accumulating sufficient experience at one institution to draw significant statistical conclusions. As long as there is controversy as to the best management of these tumors, continued reports of clinical experience in this field seem worthwhile.

The 135 patients reviewed for this study were treated prior to July 1, 1957, and all tumors were histologically proved melanoma. These include no cases of juvenile melanoma, since all patients with melanoma prior to puberty were excluded. To evaluate results in terms of 5-year survivals, only the 111 cases seen prior to July 1, 1952 were analyzed. Although there are patients treated since that date who for all purposes are well and free of disease, they are not included in the survival studies.

The follow-up was accomplished by clinic visits, personal contact with the patient or his relatives by the social worker of the Tumor Clinic, and with the help of the Department of Public Welfare of Louisiana. Death certificates of the Bureau of Vital Statistics were used when all other means failed in tracing lost patients. There were 12 patients lost to follow-up, but three of these were lost after surviving 5 years and are included as survivors. For statistical purposes, the remaining nine in this group were empirically placed in the group, dead due to disease.

## RESULTS

There were 72 male and 62 female patients in this total series with the sex and race of one pa-

\*From the Tumor Clinic, Confederate Memorial Hospital, Shreveport, Louisiana.

tient unspecified. The white patients numbered 112 whereas 22 were Negroes. The age incidence of the series is shown in table 1 and the greatest numbers of cases occurred fairly uniformly during the fifth, sixth, seventh, and eighth decades of life.

The locations of the primary tumors are listed in table 2 and the distribution is similar to that reported in other series.<sup>8, 13</sup> The largest number was found on the head and neck region, with the trunk, lower extremity, and upper extremity following in decreasing numbers. Melanomas of the lower extremity outnumbered those on the upper extremity by three to one and two-thirds of the former were located on the feet. The unknown primary sites included those patients who presented with evidence of metastases or wide dissemination where determination of site of origin was impossible. The location of the primary tumors in the 22 Negro patients was as follows: lower extremity 15 (heel, three; plantar surface of foot, six; toes, three; knee, one; calf, one; and thigh, one); upper extremity (palm, one); face, two; eye, one; and unknown, three.

There were two white female patients who were pregnant at the time a diagnosis of melanoma was established. Both gave a history of pre-existing mole at the primary site. One patient's tumor appeared localized when first seen, but after treatment, she survived only 28 months. The second patient had widely disseminated disease at the time of diagnosis, and she survived only seven months. This experience with melanoma and pregnancy is similar to that reported by others.<sup>9, 11, 13</sup> The outcome of these patients supports the theory of deleterious effect on melanoma by increased hormone secretion and the contention that pregnancy is an ominous prognostic sign in melanoma.

The 111 patients who were treated prior to July 1, 1952 were reviewed to ascertain factors influencing survival. Survival according to sex and race is computed in table 3 and rates in females of both races were superior to those in the males. A comparison of survival rates among the different age groups showed no appreciable differences for the various decades.

TABLE 1  
*Age Incidence*

Age (Years)	Number of Cases
0-9	0
10-19	3
20-29	8
30-39	17
40-49	21
50-59	25
60-69	30
70-79	20
80-89	10
Unknown	1
Total	135

TABLE 2  
*Incidence According to Location*

Site	Number of Cases	Per Cent
Head and neck	43	31.8
Eye	4	3.0
Trunk	32	23.7
Upper extremity	9	6.7
Lower extremity	27	20.0
Genitalia	3	2.2
Mucous membrane	4	3.0
Unknown	13	9.6
Total	135	100.0

TABLE 3  
*Incidence and Survival According to Sex and Race*

Sex and Race	Number of Cases	5-Year Survival	
		Number	Per Cent
White male	51	13	25.5
White female	42	14	33.3
Negro male	7	2	28.6
Negro female	10	4	40.0
Unknown	1	0	0.0
Total	111	33	29.7

Of the 111 patients, 39 gave a history of noting a pre-existing mole at the site of the primary tumor and of this group, eight survived 5 years. There were 59 patients who gave no history of previous mole and of this group, there were 21 who lived 5 years. Thirteen patients were un-

certain as to whether there was a pre-existing lesion at the primary site and four survived 5 years. An attempt to correlate survival with size of lesion in this series was unsuccessful due to inadequate measurements recorded in many cases.

An attempt was made to analyze various complaints on admission in relation to survival. Sixty-six patients had a single complaint and 45 had multiple complaints. Twenty-seven complained only of mole and nine, or one-third, survived 5 years. It is interesting that of 15 patients who had symptoms of metastases, five, or one-third, also lived 5 years. Other data from this analysis were not remarkable.

It has always been the policy of the Tumor Clinic to completely excise all moles or lesions suspected of being melanoma when first seen. For this reason only in 11 cases in this series was a diagnosis made by means other than excision. These cases included those patients with widely disseminated tumors whose primary lesions could not be located and also those with atypical lesions where melanoma was unsuspected. Since 1932 almost every conceivable form of treatment has been used and these various methods are tabulated in table 4 along with their survival rates. Simple excision was the only surgical procedure employed in 57 patients, and while this is

TABLE 4  
*Survival According to Type of Treatment*

Treatment	Number of Cases	5-Year Survival	
		Number	Per Cent
Simple excision	23	8	34.8
Simple excision and x-ray	34	8	23.5
Radical excision without graft	3	0	0.0
Radical excision with graft	7	4	57.1
Radical excision with regional node dissection in continuity	6	3	50.0
Radical excision with regional node dissection not in continuity	7	1	14.0
Simple amputation	3	0	0.0
Quarterectomy	5	3	60.0
Other methods	7	5	71.0
No treatment	16	1	6.3
Total	111	33	29.7

not recommended as definitive treatment, 16 or 28 per cent of these patients survived 5 years. In the 1930's, simple excision was followed by radiation therapy in 34 of these patients, and the survival rate after excision alone (34.8 per cent) was greater than when supplemented with roentgen therapy (23.5 per cent). These data seem to corroborate the reports of others<sup>8, 9, 13, 14</sup> that irradiation has little beneficial effect on melanoma. For this reason radiation therapy for primary melanomas is no longer advocated in this clinic.

When a diagnosis of melanoma is made in a localized lesion, adequate therapy requires radical excision of the lesion, usually with skin graft. It is our opinion that this is the minimal treatment to be employed if results are to be optimal. Of seven patients treated in this manner, four survived 5 years or longer. While this is a small group of patients, it contrasts favorably with three patients treated by radical excision without graft where there were no long-term survivors.

Where the original tumor bed is so located that it can be excised with the regional lymph nodes in continuity, this is offered the patient. Six patients were treated in this manner prior to 1952 and three (50 per cent) survived 5 years or longer. The three survivors were alive when last traced 9, 8, and 5 years after treatment. Two of these six patients had metastatic lymph nodes and one lived 9 years. Of four patients whose nodes were negative for metastases, two lived 5 years but two others were living when last traced at 37 and 46 months.

When primary melanomas cannot be resected in continuity with their regional lymphatics, radical excision with skin graft is advised and if regional lymphatic spread is predictable, simultaneous or subsequent node dissection is advocated. The fate of this group of seven patients so treated was not as favorable as the preceding group, since only one survived 5 years. Six of these seven patients had metastatic lymph nodes and all are now dead. Five lived, 1, 7, 11, 21, and 25 months, while another had a radical neck dissection 6 years after treatment of a primary cervical melanoma and then lived 3 years. The one patient of this group without lymph node involvement died 21 months after treatment. Seven patients have had radical excision of melanomas including dissection of regional lymphatics since 1952 and are not included in survival studies. Two of these patients treated

with excision and "en bloc" lymphatic dissection had no lymph node involvement and are living after 36 and 56 months. Five others had excision followed by lymph node dissection not in continuity, and three of these with involved nodes are dead at 34 and 29 months. Of two others without metastases, one died at 16 months and one is living after 24 months.

During a few of the years covered by this study, more radical resection was advised for those patients with extremity melanomas. Five patients had quadrant resection or quarterectomy prior to 1952 and three lived 5 years or longer. One survivor is still living after 11 years, one died at 7 years owing to carcinoma of the cervix, and one died at 63 months owing to metastatic melanoma. One patient treated in this manner since 1952 is living after 34 months. Two of the 5-year survivors treated prior to 1952 had involved lymph nodes while the third survivor and two patients who died had uninvolved nodes.

Seven patients were recorded as receiving "other methods" of treatment. These patients had advanced stages of the disease and several had metastases from unknown primary sources. All of these patients had metastatic lymph nodes and five survived 5 years. These patients were generally treated with inadequate surgery in the form of simple excision, lymph node excision for diagnostic purposes, or roentgen therapy alone.

There were 33 patients from the group of 111 who survived 5 years (29.7 per cent), 14 from the group of 90 who survived 10 years (15.5 per cent), eight from the group of 68 who survived 15 years (11.7 per cent) and two from the group of 30 who survived 20 years (6.6 per cent).

The primary causes of death of the patients in this series are shown in table 5. Ninety-two patients were dead at the time of series analysis,

TABLE 5  
Causes of Death

Cause	Cases	
	Number	Per Cent
Melanoma.....	48	43.2
Second malignant tumor.....	7	6.3
Unrelated cause.....	18	16.2
Unknown cause.....	19	17.1
Complication of therapy.....	0	0.0
Living when series analyzed...	19	17.1
Total.....	111	100.0



and 48 of these deaths were due to melanoma. Seven died of a second malignant tumor, 18 of unrelated causes (heart disease, cerebrovascular accident, and so forth) and 19 of unknown causes.

Seventeen of 22 Negro patients in the total series reviewed were treated prior to July, 1952, and six lived 5 years or longer (35.2 per cent). Four of these six survived 10 years and two lived 15 years. All five Negro patients treated since 1952 are dead, with the longest survivor living 44 months.

#### DISCUSSION

The over-all 5-year survival rate of 29.7 per cent in this series falls in the average range reported by other authors<sup>8, 11-13</sup> but is less than the 41.5 per cent reported by Meyer and Gumpert<sup>9</sup> and the 47 per cent rate by Vogler and his associates.<sup>14</sup> The difficulties in making valid comparisons of various series and survival data in this disease have been discussed by others.<sup>1, 8</sup> The type of patient constituting the series may be of real significance. All patients in this series were charity patients and it is well established that these lower income patients in the southern United States procrastinate in seeking medical attention and that all forms of disease seen in this hospital are more advanced, on the average, than those seen in private institutions in the same area. Furthermore, it may be of importance that such patients tend to disregard blemishes and imperfections of the skin which might bring a private patient to the physician solely for cosmetic reasons. Lastly, this group of patients is composed in part by a group of illiterates who have not had the advantages of the nation-wide cancer education program.

The current policy for the treatment of melanoma in our Tumor Clinic closely parallels that reported by other institutions<sup>9, 13-15</sup> and is based on the premise that radical surgery is the best therapy available. This consists of radical excision of the primary lesion, and this may require amputation. Lymph node dissection, in continuity if possible, is advised if areas of lymphatic spread are accessible and predictable. The efficacy of this procedure is controversial and the small number of patients in this series does not furnish significant evidence to decide the problem. This series does indicate that the finding of metastatic lymph nodes in melanoma, as in other

forms of cancer, decreases the chance of long-term survival. The results of these cases combined with those reported by others<sup>4, 8, 9, 13, 14</sup> strongly suggest that lymph node dissections, both prophylactic and therapeutic, are worthwhile in this disease.

Super-radical surgery, such as hemipelvectomy or interseapulothoracic amputation has been abandoned here as a routine form of therapy even though the results were good. This was done after a limited trial because of the conviction that the small increase in survival which might accompany it did not outweigh the associated mutilation and disability. It is interesting that similar conclusions were reached by others.<sup>4, 9, 13, 15</sup>

To advocate a radical surgical approach to this problem as outlined above, one should be able to show increased survival rates to justify the increase in morbidity, and perhaps mortality, which might accompany more extensive surgical procedures. With this in view, the patients in this series were divided into two categories, those who had inadequate or no treatment (78 patients) and those who were considered to have had optimal or more radical treatment (33 patients). The 5-year survival rate for the former group was 25.6 per cent while that for the latter was 39 per cent. These data give support to the present therapeutic policy of radical surgery.

A review of cases of the type reported here should emphasize that one should be relentless in pursuit of melanoma, even though the situation appears hopeless. Among the unexplained aspects of the melanoma problem is the unpredictability of its life history or course in a specific patient. It is well appreciated that many patients with extensive or disseminated disease possess considerable tolerance or resistance to its ravages and continue to live for many years. This is well exemplified by the group of this series listed as receiving "other methods" of treatment. It seems justified to continue to treat melanotic lesions as they appear by whatever method seems expedient, because in numerous cases, the therapy will aid in controlling the disease even when the outlook is exceedingly poor.

The occurrence of melanomas in 22 Negro patients is worthy of note. The rarity of this tumor in the Negro race is attested to by numerous previous reports.<sup>2, 3, 5-7, 9, 10, 13</sup> Its incidence has been estimated<sup>1, 4, 10</sup> as being four to five times

greater in the white patient but reported series seem to indicate an even greater rarity. The ratio of colored to white patients in this institution is 2.6 to 1 while the ratio of colored to white patients with melanoma was 1 to 5.1. It has been noted that the majority of melanomas in Negroes occur on the feet and 12 of the 22 tumors were so located. A 5-year survival rate of 35.2 per cent for this group of patients is somewhat higher than that for the total series but there is little to suggest that this represents a true superiority of prognosis in the Negro race.

## SUMMARY

Data on 135 patients with malignant melanoma treated since 1932 were reviewed for this report. Incidence of these lesions according to age, sex and body distribution is tabulated and the effects of these and other factors on survival are recorded.

An analysis of the various forms of treatment utilized during the 25-year period is presented and a 5-year survival rate of 29.7 per cent is reported. The current policy of treatment with radical surgery is outlined. Its efficacy is denoted by a 13.4 per cent improvement in 5-year survival rate over less aggressive forms of treatment utilized in this series. Results of various forms of therapy in patients with metastatic melanoma emphasize the wisdom of relentless pursuit of the disease, even in its advanced stages.

Twenty-two Negro patients are included in the analysis of the total series. Specific details of this group are reported because of the rarity of melanoma in the Negro race.

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## REFERENCES

1. ALLEN, A. C., AND SPITZ, S.: Malignant melanoma. A clinicopathological analysis of criteria for diagnosis and prognosis. *Cancer*, 6: 1, 1953.
2. ANDERSON, W. A. D.: Disease in the American Negro. I. Melanoma. *Surgery*, 9: 425, 1941.
3. BAXTER, H.: Malignant melanoma in colored races. Report of case originating in mouth. *Canad. M. A. J.*, 41: 350, 1939.
4. BOOHER, R. J., AND PACK, G. T.: Malignant melanoma of the feet and hands. *Surgery*, 42: 1084, 1957.
5. CHARACHE, H.: Malignant melanoma in the Negro. *New York J. Med.*, 50: 1369, 1950.
6. ENOS, W. F., AND HOLMES, R. H.: Malignant melanoma in the tropics. *Am. J. Path.*, 27: 523, 1951.
7. IMLER, A. E., AND UNDERWOOD, J. W.: Malignant melanoma in the Negro, with report of six cases. *South. Surgeon*, 13: 61, 1947.
8. LUND, R. H., AND IHLEN, M.: Malignant melanoma: clinical and pathologic analysis of 93 cases. *Surgery*, 38: 652, 1955.
9. MEYER, H. W., AND GUMFORT, S. L.: Malignant melanoma—appraisal of the disease and analysis of 105 cases. *Ann. Surg.*, 138: 643, 1953.
10. MORRIS, G. C., AND HORN, R. C.: Malignant melanoma in the Negro. *Surgery*, 29: 223, 1951.
11. PACK, G. T., GERBER, D. M., AND SCHARNAGEL, I. M.: End results in treatment of malignant melanoma. *Ann. Surg.*, 136: 905, 1952.
12. PRESTON, F. W., POWERS, R. C., CLARKE, T. H., AND WALSH, W. S.: Malignant melanoma. *A. M. A. Arch. Surg.*, 69: 385, 1954.
13. STEWART, D. E., HAY, L. J., AND VARCO, R. L.: Collective review malignant melanomas: 92 cases treated at University of Minnesota Hospitals since January 1, 1932. *Surg. Gynec. & Obst.*, 97: 209, 1953.
14. VOGLER, W. R., PERDUE, G. D., AND WILKINS, S. A., JR.: A clinical evaluation of malignant melanoma. *Surg. Gynec. & Obst.*, 106: 586, 1958.
15. WILKINS, S. A., JR.: Management of melanoma. *Am. Surgeon*, 24: 148, 1958.

## SHOULDER DISABILITY FOLLOWING RADICAL NECK DISSECTION\*

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A radical neck dissection with excision of the spinal accessory nerve results frequently in permanent shoulder disability. Many surgeons insist that adequate dissection in the posterior cervical triangle necessitates resection of this nerve. Others are more conservative in the extent of their operation. On our Surgical Service, the spinal accessory nerve was routinely sacrificed. The resulting disability has caused us to assess this condition.

Such shoulder disability is caused by the loss of the accessory nerve, trapezius palsy, muscle imbalance, displacement of the shoulder girdle, and periarthrititis. Injury of the upper cervical nerves, removal of the sternocleidomastoid, omohyoid, strap, and other muscles add to the disability.

Surprisingly, this condition has received very little attention in the literature. Accessory nerve injury as the result of operative procedures in the posterior cervical triangle produces a major complication. Nerve repair and elaborate plastic procedures have been tried so as to correct the resultant disability with varying degree of success. In the case of radical neck dissection, the nerve is resected as an essential of successful cancer surgery. Thus, both the surgeon and the patient are willing to accept it as a necessary compromise.

The accessory nerve was resected in all of our patients but the extent of the disability proved to be unpredictable from patient to patient. This outstanding feature of accessory nerve injury may be well demonstrated.

### CASE REPORTS

*Case 1.* C. N. (126 468), a 47-year-old white male patient had a total laryngectomy for carcinoma of the larynx in 1950 and a right radical neck dissection and hemiglossectomy for carcinoma of the tongue in December 1957. Slight atrophy of the upper trapezius fibers developed. Abduction of the arm was limited to 65° but flexion in the anterior and anterolateral directions was easily

accomplished to 120°. The change in the position of the scapula was minimal. Shrugging of the shoulder was powerful and the arm retained almost normal strength. The patient's complaints were limited to the range of abduction.

*Case 2.* W. B. (126 219), a 63-year-old white male patient had had a right radical neck dissection and hemimandibulectomy for carcinoma of the tonsil in December 1957. Atrophy of the upper trapezius fibers developed and the scapula became displaced in the lateral, anterior, and inferior directions. Abduction of the arm was limited to 75 to 80°. Motor strength was not perceptibly impaired. He notices only slight tightness and stiffness of the shoulder in the morning. Functional use of the arm is good.

*Case 3.* G. N. (125 807), a 61-year-old white male patient had a left radical neck dissection, hemimandibulectomy and hemiglossectomy for carcinoma of the tongue in December 1957. He also had a long history of bronchiectasis and chronic pulmonary tuberculosis. Atrophy of the upper trapezius fibers, displacement, and prominence of the scapula were very conspicuous. Abduction of the arm was limited to 45°. Passive abduction increased the range of motion 10°. The scapulohumeral joint was frozen beyond this point. Flexion and extension were almost normal. Shrugging of the shoulder was absent. The patient complained of intermittent pain around the shoulder especially in the area of the intertubercular sulcus, around the upper margin of the scapula, and in the supraclavicular fossa. Sedatives, analgesics, local application of heat, shoulder exercises and temporary immobilization of the arm in a sling offered relief.

*Case 4.* L. F. (126 861), a 64-year-old white male had a total laryngectomy for carcinoma of the larynx two years prior to the present admission. Left and right radical neck dissections were performed for metastases in October and December 1957, respectively. Atrophy of the trapezius and displacement of the shoulder developed bilaterally. Abduction of the right arm was limited to 50° and of the left arm to 60°. Passive abduction of both arms was possible to 80 to 85° but the motion was very painful. Elevation of both arms was possible to 120° in the anterior and anterolateral directions. The levator scapulae muscles were hypertrophied and shrugging of the shoulder

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remained strong. The patient complained of considerable pain in both shoulders especially in the anterior aspect of the joints. A poorly defined discomfort was present in both supraclavicular fossae. The right shoulder was affected to a greater extent than the left. Analgesics, local application of heat, shoulder exercises, and resting of the arm in a sling have offered temporary relief. Clothing, eating, and personal toilet are considerably handicapped by these bilateral painful shoulders.

*Case 5. B. A. J. (127 374),* a 64-year-old white man had a radical neck dissection and hemimandibulectomy for secondary squamous cell carcinoma of the right submaxillary area in April 1958. Drooping of the shoulder and lateral displacement of the right scapula developed. Abduction of the right arm was limited to 60°. Flexion was possible to 110 to 120°. Shrugging was moderately diminished in strength and occasional discomfort was present in the area of the shoulder joint. A frozen shoulder of moderate severity was present on the left side. X-ray examination of the right shoulder was negative. In spite of some pain, weakness, and limited motion of the right shoulder, he had fairly good functional use of the arm.

*Case 6. E. S. (127 540),* a 63-year-old white man had a right radical neck dissection and hemiglossectomy in October 1956 for carcinoma of the tongue. Anterior, lateral, and inferior displacement of the right shoulder was pronounced. The right scapula and clavicle were very prominent. Abduction of the right arm was possible to 45°. Passive abduction increased the range of motion to 65°. The joint was frozen beyond this range. Flexion was painful at 80°. Shrugging of the shoulder was weak and the strength of the arm was diminished. He complained of intermittent discomfort around the right shoulder. There was clinical and x-ray evidence of arthritis in both shoulders. The left shoulder was frozen to the same extent as the right.

#### COMMENTS

The main and direct cause of this type of shoulder disability is undoubtedly accessory nerve injury. The nerve emerges from the jugular foramen, pierces the muscle belly of the sternocleidomastoid, and crosses the posterior cervical triangle in an oblique downward course to the anterior border of the trapezius muscle. Throughout its course in the posterior cervical triangle, it is covered by the outer layer of the deep cervical fascia, the superficial fascia, and the skin. It communicates with branches of the second, third, and fourth cervical nerves as it descends on the

posterior surface of the trapezius. In general, the upper third or half of the trapezius muscle receives its motor fibers from the accessory nerve and the lower two-thirds from the upper cervical nerves. The accessory nerve carries proprioceptive as well as motor fibers and there are considerable variations in its course and in the overlap of innervation between accessory and upper cervical nerves.<sup>3</sup> The capricious course and composition of the nerve is the first factor explaining the variable extent of disability. A second factor is the amount of imbalance between the affected trapezius and other shoulder muscles. According to Inman and co-workers,<sup>4</sup> the upper third of the trapezius, the levator scapulae, and the upper digitations of the serratus anterior muscle actively elevate the shoulder and form the upper component of scapular rotation. The inferior third of the trapezius with the lower four digitations of the serratus anterior muscle provide the lower rotary force. The middle third of the trapezius muscle seems to fix the scapula in its position during abduction.

*Change in the configuration of the shoulder.* The classic picture of "shoulder droop" is the result of altered interrelation of all components of the shoulder. The upper trapezius fibers atrophy to a

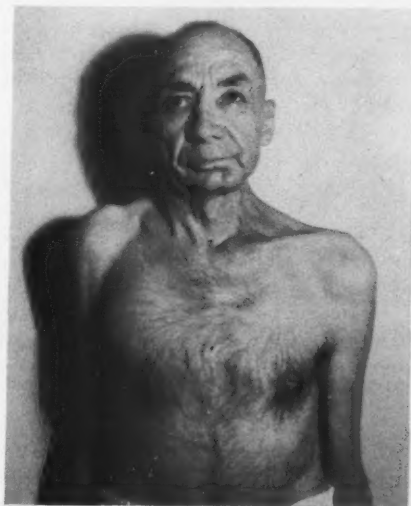


FIG. 1. The affected shoulder is displaced anteriorly, laterally, and inferiorly. The anterior axillary fold is lowered. The clavicle is prominent and runs an almost horizontal course. The supraclavicular fossa is wide and deep due to the loss of its contents and atrophy of the trapezius.

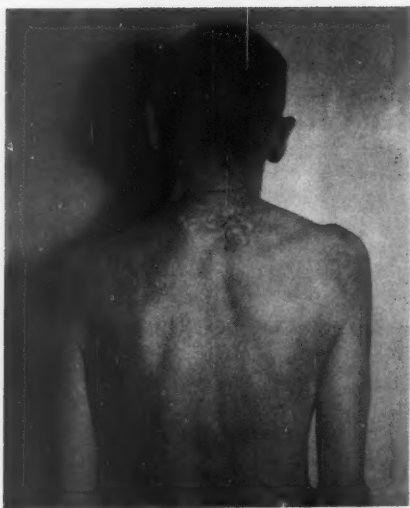


FIG. 2. The left scapula is pulled laterally, inferiorly, and rotated inferiorly. Its vertebral margin is distant from the midline. The margins, angles, and spine of the left scapula are prominent. Shrugging is very weak.



FIG. 3. Abduction of both arms is limited to  $45^\circ$  with bilateral neck dissection. Passive abduction is possible to  $80^\circ$  but it is very painful. The hypertrophied levator scapulae have preserved a powerful shrugging motion.

greater or lesser extent. Notching may not be very prominent due to the hypertrophy of the levator scapulae muscle. From the anterior view, lowering and anterior displacement of the shoulder is easily detected (fig. 1). The anterior axillary fold is lowered. The clavicle becomes prominent due

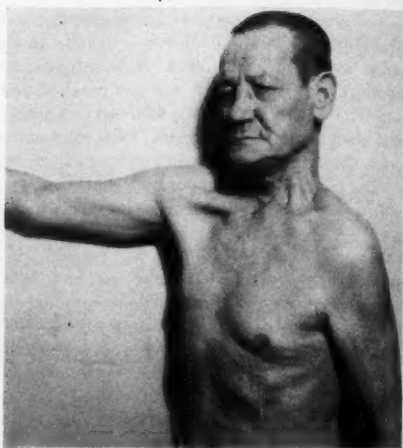


FIG. 4. While the abduction is considerably limited, the patient could easily elevate his arm to  $90^\circ$  or even higher in the anterior and antero-lateral directions.

to the loss of the sternomastoid attachments. The supraclavicular fossa deepens and widens due to loss of its contents. Normally, the clavicle passes from its sternal articulation upward, laterally, and backward. In the case of "shoulder droop," it runs a horizontal or even downward course. In abduction of the arm, the anterior displacement of the clavicle becomes even more noticeable. From the posterior view, the scapula is displaced laterally, inferiorly, and rotated inferiorly (fig. 2). The median and superior margins, the superior and inferior angles and the spine of the scapula become prominent due to wasting of the trapezius. Inactivity and atrophy of the other muscles may accentuate this prominence. True "winging" of the scapula, as seen in serratus anterior muscle palsy, is not observed in these cases.

*Altered function of the shoulder girdle.* With the resection of the accessory nerve, the all important rotary and fixing function of the trapezius is lost. Abduction in the scapulohumeral joint was limited in all cases to  $45$  to  $80^\circ$  (fig. 3). Passive abduction was possible to near  $90^\circ$  in some cases although the motion was painful. Freezing occurred in some instances. All of our patients were able to elevate the arm in the anterior and antero-lateral directions to or above the horizontal level (fig. 4). Flexing of the arm, the elbow, and arching the thoracic cage serve to compensate for the decreased abduction. Shrugging of the shoulder

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was weak in some cases but powerful in others due to hypertrophy of the levator scapulae muscle. Shrugging motion was certainly of a limited value as an indicator of trapezius integrity.

**Frozen shoulder.** In some patients a frozen shoulder was observed. The contracture appeared to be the result of inactivity, palsy, muscle imbalance, and pain. Muscular inactivity was blamed for slow circulation as well as venous and lymphatic stasis around the shoulder joint. The periarticular tissues become saturated with serofibrinous exudate producing intra- and extra-articular adhesions.<sup>1</sup> One of our patients had shoulder difficulties prior to operation. Another patient had x-ray evidence of degenerative changes in the scapulohumeral joint. Since a frozen shoulder failed to develop in all patients having had a neck dissection, it seems that trapezius palsy is only one of the contributing factors. It possibly triggers the low grade inflammatory process of periartthritis in predisposed cases.

**Cosmetic effect: disfigurement.** While some of our patients were conscious of the drooping shoulder, none of them have expressed concern from the cosmetic standpoint. The shoulder is covered by clothing and among the elderly patients, the disfigurement was of no significance.

**Economic implication: capacity to work.** The limited usefulness of the affected arm involves both the range of motion and muscle strength. While this factor may be very important for the young, active, and wage earning individual, among the elderly retired patients, it played a minor role. Residents of the Veterans Domiciliary Home perform a certain amount of physical work around their living quarters and some of our patients requested an excuse from these duties because of a painful sholder.

**Eating, clothing, personal toilet.** All patients were more or less handicapped in the performance of their daily activities such as putting on a coat or shirt, hairdressing, and shaving. They modified the necessary motion or used the unaffected arm. The patient with bilateral dissection was considerably more handicapped. One patient with a bilateral painful shoulder was unwilling to abduct his arm while eating. He kept his arms firmly adducted and used the motions of the forearm joints to carry food to his mouth.

**Shoulder disability due to pain.** Since the sensory fibers of the upper cervical nerves were routinely sacrificed, a certain amount of sensory loss and paresthesias were always present on the side of the neck and around the ear. Some patients were free of pain while others were constantly harassed by shoulder discomfort. The pain was localized on the involved side of the neck and in the supraclavicular fossa or along the upper margin of the scapula. It was often diffusely distributed around the shoulder and occasionally it extended to the arm or to the anterior chest wall. The pain was always aggravated by physical activity. There are several factors responsible for this pain. The pain and discomfort in the supraclavicular fossa is caused by injury to the upper cervical nerves. These are severed during the dissection as they emerge from beneath the prevertebral fascia. The attachment of the nerve stumps to the scar may cause considerable postoperative pain. Neuromas were observed by several writers and excised.<sup>5, 6</sup> It was suggested by Ewing and Martin<sup>2</sup> that a major portion of the shoulder pain is caused by chronic strain on the imbalanced muscles. This theory is substantiated by the observation that elevation of the displaced arm in a sling alleviates the pain. The pain due to a frozen shoulder has a diffuse distribution around the joint being most marked in the intertubercular sulcus. Commonly, it is not easy to differentiate the exact cause of a painful shoulder and the presence of multiple factors must be assumed.

**Management of shoulder disability.** While the economic and cosmetic aspects of the shoulder disability played a minor role in our experience, the painful shoulder presented a serious challenge in several cases. Since the damage was permanent, the treatment remained symptomatic and so far as the frozen shoulder was concerned, preventive. I am not aware of any attempt to perform nerve repair or scapula fixing procedures in these patients. Sedatives, analgesics, and local application of heat were very valuable in alleviating discomfort. Shoulder exercises seemed to be useful in preventing, or rather slowing down, the process of periartthritis. Elevation of the displaced arm in a sling offered considerable relief. However, the patients were reluctant to keep their arms in a sling for any length of time after the shoulder discomfort subsided. The response to these measures was always temporary.

## SUMMARY

Radical neck dissection with excision of the spinal accessory nerve usually results in a permanent shoulder disability. The disability is caused by trapezius palsy, muscle imbalance, and frozen shoulder. The range of motion and strength of the arm are decreased and the shoulder is commonly painful. Pain was the most important disabling factor among our patients. Sedatives, analgesics, local application of heat, shoulder exercises, and elevation of the arm in a sling have offered temporary relief.

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## REFERENCES

1. DePALMA, A. F.: Symposium on orthopedic surgery; frozen shoulder. *S. Clin. North America*, **33**: 1711, 1953.
2. EWING, M. R., AND MARTIN, H.: Disability following "radical neck dissection." *Cancer*, **5**: 873, 1952.
3. Goss, C. M. (editor): *Gray's Anatomy*, Ed. 26, p. 1021. Lea & Febiger, Philadelphia, 1954.
4. INMAN, V. T., SAUNDERS, J. B. D. M., AND ABBOTT, L. C.: Observations on the function of the shoulder joint. *J. Bone & Joint Surg.*, **26**: 1, 1944.
5. MOORE, C.: Neck dissection. *J. Kentucky M. A.*, **54**: 947, 1956.
6. TEMESVARI, A., AND VANDOR, F.: Über Komplikationen nach cervicalen Dissektionsoperationen. *Chirurg*, **25**: 437, 1954.

## Editorial

## APATHY AND CHAOS

Planning, careful, accurate, comprehensive planning, and not individual professional competence will be the key to success in the medical management of a mass casualty situation. If much planning in this direction has been done (outside of the military) it is not immediately apparent either to the general public or to the members of the medical profession. Ask the average physician what he would do, where he would go, or what his duties might be in the event of a thermonuclear attack and he is at a loss for an answer. At a recent symposium on the management of mass casualties in one of the largest cities of the United States the lack of interest of the profession was distressingly demonstrated. The program was carefully planned and adequately publicized by the City Medical Society and the City Health Department. The speakers were recruited experts from the Armed Forces and from the Staffs of Medical Schools in the area. Held in an auditorium which would accommodate some 2000 persons, there were less than 10 physicians (exclusive of participants) present in an audience of approximately 150 people. A moderate number of the remaining 140 persons was a "captive" audience from an Army Reserve Hospital Unit.

One of the more distressing features of this apparent apathy is its persistence in spite of the fact that the medical profession has demonstrated repeatedly its inability to handle adequately even moderate numbers of casualties in the time of civil disaster.

It is true that in recent years most hospitals have "plans for emergency" formulated by disaster committees. It is also true that the plans for the most part are far from adequate. The details of these plans are totally unknown in many instances to members of the visiting and resident staffs. The disaster committee chairman of a large metropolitan hospital recently reported having on hand 20 folding cots and 10 first aid packets available in the event of a disaster; these were stored in a relatively inaccessible space within the hospital. In casual conversation I asked a large segment of the resident and attending staff of that same institution what comprised the disaster plan of the hospital and in not a single instance did I receive a knowing answer.

Not only are physicians in general uninformed of the planning of responsible parties but they are also unfamiliar with the *basic concepts* of medical

mass casualty management. The responsibility for this deficiency in knowledge must be accepted by the individual physician. The exhaustive studies and recommendations of the Armed Forces are available in the literature to all and yet not one physician in 20 is familiar with these basic concepts.

The overwhelming medical work load created by a thermonuclear attack would necessitate a drastic compromise of conventional medical standards. Decisions would have to be made concerning the need for emergency operation or resuscitation or the lack of propriety in performing operations or resuscitation because of the intrinsic lethality of a given wound. Our present concepts of treating the most seriously injured first would be discarded. The great majority of the critically injured would be treated expectantly or not at all. Our aims must be to do the most good for the greatest number of injured. To accomplish this aim the basis of medical care will be sorting or triage. This of course will be necessitated by the great disparity between the number of injured and the personnel and facilities available for treatment. In the initial hours following an attack most surviving physicians will probably be "triage officers." If maximum survival is to be realized then the actual therapy of patients will be performed by the laity. To meet this challenge large numbers of the population must become competent "aid men." Again the responsibility for training these persons must be accepted by the profession.

Now is the time for the medical profession to shake its apathy and to plan individually and collectively for a moment which we hope may never arrive. The top echelon planners should more effectively disseminate the details of their planning. The individual physician should familiarize himself with the "foreign" but basic concepts of mass casualty management. The members of the medical profession should assume the initiative in training the laity in first aid fundamentals.

Even with the most comprehensive, careful planning on our part a thermonuclear attack will bring confusion; without it, there will be chaos.

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## Book Reviews

*The editors of THE AMERICAN SURGEON will at all times welcome new books in the field of surgery and will acknowledge their receipt in these pages. The editors do not, however, agree to review all books that have been submitted without solicitation.*

*Surgical Technique and Principles of Operative Surgery*, Ed. 6. By A. V. PARTIPILO, M.D., F.A.C.S., 966 pp., Lea & Febiger, Philadelphia, 1957.

This sixth edition by Dr. A. V. Partipilo of *Surgical Technique and Principles of Operative Surgery* has been thoroughly revised and brought up to date on the ever changing subject, concepts, and principles of operative surgery. Many sections such as cardiac and thoracic surgery have been brought up to date. It is interesting that the author and his contributors have attempted to bring out the pathologic physiology of the various procedures and conditions which they describe. This volume covers the field of surgery starting with a brief history and continuing to the present day use of radioisotopes. This is a good book for the advanced medical student, house officer, and general surgeon who does not have a wide experience in handling many of the major problems that occur today in the general surgeon's practice. It is well illustrated with over 1000 illustrations and drawings. It is written in a simple and straight forward manner so that it makes pleasant, easy reading.

THURSTON R. ADAMS, M.D.

*A Stereoscopic Atlas of Human Anatomy, Section IV, The Thorax*. By DAVID L. BASSETT, M.D. Sawyer's, Inc., Portland, Oregon, 1958.

In 1954, Section II, The Head and Neck, and in 1955, Section III, The Upper Extremity, were reviewed in this journal. The same high quality of material and presentation has been maintained in this section that was manifested in Sections I, II, and III.

For those unfamiliar with these atlases, a description is warranted. The volumes consist of sets of "View-Master" stereoscopic reels of color slides which are indexed with labeled line drawings and descriptions for each stereo pair. The drawings are made from actual projections of one of each stereo pair, hence correlate precisely.

In Section IV, The Thorax, the quality of the

Kodachrome pairs exceeds, if possible, that found in the preceding sections. William B. Gruber, the photographer, is to be congratulated as is Mrs. Lorene Sigal who made the accurate line drawings.

This section, as well as those preceding it, are to be enthusiastically recommended to both students, practitioners, and teachers. These stereoscopic views and accompanying drawings are the nearest pedagogic approach to actual dissection possible. As a supplement to the anatomic laboratory they would be invaluable.

When complete, or even at present, they might well be on the "required" list of all schools of medicine for their first year enrollees. For the practicing surgeon they provide a brief, accurate and stimulating review of any anatomy in which he may be concerned. This entire atlas as completed to date, must be seen to be truly appreciated.

T. G. ORR, JR., M.D.

*Operative Surgery*, Vol. 7. By CHARLES ROB, AND RODNEY SMITH. Butterworth & Co., Ltd., London, 1958.

Volume 7 of this series on *Operative Surgery* is devoted to the breast and genito-urinary system. The authors continue the excellent presentation of graphic and literary matter in this volume as noted in the previous volumes. The text is profusely illustrated with excellent drawings depicting the various procedures step by step.

The section devoted to the breast includes operations performed for both malignant and benign conditions, but it fails to include the various super-radical procedures.

The major portion of this volume is devoted to the genito-urinary system. The sections are entitled: Access; Kidney; Ureter; Bladder; Prostate and Vesicles; Urethra; Penis; Testicle and Its Covering; and Minor Procedures. The topics are well covered.

This book would be a worthwhile addition to the libraries of those surgeons concerned with the genitourinary tract. The cost of this book would not justify its acquisition merely for the section on the breast for those not involved in genito-urinary surgery.

ROGER D. SCOTT, M.D.

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